(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 099 456 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
05.02.2003 Bulletin 2003/06

(51) Int Cl.[7]: **A61M 39/24**, G05D 7/01, F16K 15/18

(21) Application number: **00830725.8**

(22) Date of filing: **31.10.2000**

(54) **Check valve for medical infusion lines and the like**

Rückschlagventil für medizinische Infusionsleitungen und dergleichen

Clapet antiretour pour des lignes de perfusion et similaires

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
RO SI

(30) Priority: **12.11.1999 IT TO990975**
14.12.1999 IT TO991093
13.06.2000 IT TO200571

(43) Date of publication of application:
16.05.2001 Bulletin 2001/20

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EP 1 099 456 B1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention refers to check valves for medical infusion lines and the like. More in particular, the invention regards an anti-siphon (or non-return) valve for such medical lines.

[0002] These valves traditionally include a first and a second tubular element mutually coaxial to each other and respectively defining an upstream passageway and a downstream passageway, a diaphragm of elastically deformable material transversely positioned between said first and a second tubular elements and acting as a fluid seal in combination with an annular valve seat to keep the said control valve normally closed, wherein a predetermined fluid pressure in the said upstream passageway causes flexion of the said diaphragm and the consequent opening of the valve.

[0003] These valves, which are normally closed, must be capable of promptly opening when the pressure in the upstream passageway exceeds a predetermined threshold. In the particular case of an anti-siphon valve, this threshold is much higher than in the normal check valves used in similar medical applications, and is typically in the range from 1 to 5 psi.

[0004] In addition, in some applications and particularly in the case of anti-siphon valves, it must be possible to control the opening of the valve diaphragm independently of the pressure in the upstream passageway. This manoeuvre can be required, for example, in cases of priming a pump (normally a peristaltic pump) associated with the medical line, when the infusion must be given under the effect of gravity, or also when the medical line is washed or bled.

[0005] The object of the present invention is to provide a check valve of the above-defined type, designed to meet the aforesaid requirement and with simple and low-cost manufacture, also with regards to assembling.

[0006] Another object of the invention is to provide a check valve of the above-defined type, the opening of which can be controlled in an easy and practical manner.

[0007] According to the invention, these objects are essentially achieved via the characteristics defined in Claim 1.

[0008] Additional, advantageous, secondary characteristics of the valve are defined in sub- Claims 2-42.

[0009] The invention will now be described in detail with reference to the enclosed drawings, which are supplied purely as a non-limitative example, and where:

- figure **1** is a schematic perspective view of a check valve in conformity with the invention.
- figure **2** is an axial section view along the II-II line of figure 1.
- figure **3** is a similar view to that of figure 2, showing the valve in the controlled open position.
- figure **4** is a schematic perspective view of a first variant of the check valve in conformity with the invention.
- figure **5** is an axial section view along the VI-VI line of figure 4.
- figure **6** is a similar view to that of figure 5, showing the valve in the controlled open position.
- figure **7** is a schematic perspective view of a second variant of the check valve in conformity with the invention.
- figure **8** is a similar view to that of figure 7, in larger scale and partially sectioned.
- figure **9** is an exploded view of figure 7.
- figure **10** is an axial section view along the X-X line of figure 7.
- figure **11** is an axial section view along the XI-XI line of figure 7, in which another variant has been inserted.
- figure **12** is a similar view to that of figure 10, showing the valve in the controlled open position.
- figure **13** is an enlarged perspective view of another variant of the check valve in conformity with the invention, with the valve shown in its normally closed position.
- figure **14** is a similar view to that of figure 13, showing the valve in the open position.
- figure **15** is a side view of figure 13.
- figure **16** is a side view of figure 14.
- figure **17** is an axial section view along the XVII-XVII line of figure 15.
- figure **18** is an axial section view along the XVIII-XVIII line of figure 16.
- figure **19** is a perspective of a component of the valve viewed from below.
- figure **20** is a side view of another component of the valve.
- figure **21** is a larger-scale, cross section view along the XXI-XXI line of figure 16.
- figure **22** shows a detail of figure 17 in greater scale, prior to assembling of the valve.

[0010] With initial reference to Figures 1-3, reference numeral 1 indicates a valve assembly in conformity with the invention, the illustration referring specifically to an anti-siphon valve for medical infusion lines and similar applications. In the case of the illustrated example, the valve (1) is designed for tube-to-tube connection: it should be noted however that it could also be set up for Luer-tube, tube-Luer or Luer-Luer connections.

[0011] The body of the valve (1) is composed of a two hollow parts, respectively indicated as 2 and 3, both of which are normally made of a suitable moulded thermoplastic material, such as polycarbonate, and permanently joined together using, for example, ultrasonic welding, gluing or equivalent systems. These parts are conveniently devoid of complex forms and can therefore be produced using relatively uncomplicated moulds.

[0012] The first part (2) is composed of an essentially circular-shaped cap with a lateral appendage (4) forming the first tubular element (5) that defines an upstream passageway, or inlet passageway (6).

[0013] Part 2 is moulded with an elastically sprung, annular wall of reduced thickness (8), which in turn is integrally moulded with a central cylindrical member (9) to form a control plunger, as will be explained in the following. In the illustrated example, the annular wall (8) has annular ribbings or corrugations arranged on axially staggered planes, thereby assuming the general shape of a spring.

[0014] The plunger (9) has a reduced-diameter spigot (10) at one end, forming a manual control member of the valve (1), while the other end (11) has a convex surface, for example spherical or simply flat.

[0015] As it will appear evident in the following, the elastically spring annular wall (8) forms an elastic member that tends to hold the plunger (9) in the retracted, inoperative position shown in figure 2. The elastic wall (8) is elastically deformable to allow the plunger (9) to move to the advanced, operative position shown in figure 3.

[0016] The second part (3) of the body of the valve (1) has a generally complementary form to that of the first part (2), one portion with a generally circular section (12) and a lateral appendage (43) corresponding to the lateral appendage (4) of part 2. The circular portion (12) is integrally moulded with a second tubular connector (13) that defines a downstream passageway, or outlet passageway (14).

[0017] Parts 2 and 3 of the body of the valve (1) form between them a chamber (15) that communicates laterally with the first tubular connector (5), or rather with the inlet passageway (6), and is axially connected with the outlet passageway (14) via a one-way valve with both spontaneous and controlled opening, generally indicated as 16.

[0018] The valve (16) basically consists of an elastic obturator formed by a cup-shaped element (17), which has a circular end wall (18) and a shell or side wall (19) with a cylindrical shape or, more suitably, a diverging conical surface at the part opposite to the end wall (18).

[0019] The end wall (18) can be of even thickness or, more suitably, be thicker towards its centre. Similarly, the side wall (19) can be of even thickness or, more suitably, be thicker towards its free edge (20).

[0020] The external circumferential edge (21) of the end wall (18) can be sharp, as in the case of the illustrated example, or rounded.

[0021] The cup-shaped element (17) is normally moulded as a single piece of soft elastomeric material, especially liquid silicone that is injection moulded using a central injection point.

[0022] The cup-shaped element (17) is inserted, coaxially with the outlet passageway (14), so that it rests on the annular wall (22) of the second part (3) of the body of the valve (1), which has a channelled surface formed by a halo of radial channels (23) communicating with the outlet passageway (14). The radially external tip of each radial channel (23) is extended by a respective axial channel (24) moulded into wall of the second part (3) of the body of the valve (1) facing the side wall (19) of the cup-shaped element (17). The channelled surface (22) can also be formed around the outlet passageway (14) with axial ridges not shown in the drawings.

[0023] The external circumferential edge (21) of the end wall (18) of the cup-shaped element (17) rests against an annular valve seat (25) formed by the conical surface of a ring insert (26), housed and axially blocked inside the chamber (15), and coaxial with the outlet passageway (14). The axial plunger (9) slidably passes coaxially through the ring (26) with some radial play, the convex end (11) of the plunger resting against the external face of the end wall (18) of the cup-shaped element (17).

[0024] The annular valve seat (25), normally closed and sealed by the circumferential edge (21) of the cup-shaped element (17), communicates with the inlet passageway (6) via the chamber (15) and axial passages defined between the plunger (9) and the ring (26): in the case of the illustrated example, the plunger (9) is fashioned with longitudinal recesses and more suitably, as can be clearly seen in figures 2 and 3, has a cross-shaped cross-section. This arrangement is nevertheless provided purely as an example.

[0025] The spigot (10) of the plunger (9) constitutes the manually operable control member for selectively controlling the opening of the valve, by correspondingly deforming the annular elastic wall (8).

[0026] Operation of the valve (16) is as follows.

[0027] The above described arrangement is such that in the assembled state of parts 2 and 3 of the body of the valve (1), the cup-shaped element (17) is subjected to a predetermined axial elastic preloading: thus the peripheral edge (21) of its end wall (18) is kept elastically pressed against the annular valve seat (25) by the axial force exerted by the side wall (19), as well as by the consequent radial force applied by the end wall (18) due to the conical shape of the valve seat (25). This condition corresponds to the normally closed position of the valve in conformity with the invention, whereby flow from the upstream passageway (6) to the downstream passageway (14) is prevented in an effective and safe manner.

[0028] When an overpressure exceeding a predetermined threshold (e.g. in the range 1-5 psi in the case of anti-siphon applications) develops in the upstream passageway (6), the valve passes immediately from the closed position to the open position due to flexion of the end wall (18) of the cup-shaped element (17), possibly combined with a partial axial elastic yielding of the side wall (19). This flexion, corresponding to that shown in figure 3, which illustrates the controlled and non spontaneous opening of the valve, causes the peripheral edge (21) to move away from the annular valve seat (25), producing an annular opening between them. The upstream passageway (6) is thus put in connection with the downstream passageway (14) via the chamber (15), the axial passages between the plunger (9) and the ring

(26), the annular opening (44), the axial channels (24) and the radial channels (23).

[0029] As already stated, the spontaneous opening of the valve also occurs promptly even if the diaphragm formed by end wall (18) of the cup-shaped element (17) is subjected to high axial preloading for ensuring maximum safety and reliability in closure. In fact, the force imparted against the end wall (18) by the pressure reaching the threshold value causes its elastic deformation into an essentially concave hemispheric shape (as shown in figure 3), resulting in the peripheral edge (21) separating from the conical-surface valve seat (25) with a certain amount of amplification. Therefore, in practice a modest pressure beyond the threshold level is sufficient to cause the spontaneous opening of the valve in a rapid and immediate manner, reducing any risks of undesired adherence between the edge (21) and the valve seat (25), even after prolonged periods of valve closure that might prejudice opening.

[0030] Spontaneous return to the closed position of the valve (16) when the pressure balance between the upstream passageway (6) and the downstream passageway (14) is re-established, or in the case of overpressure in the downstream passageway (14), occurs immediately due to the end wall (18) of the cup-shaped element (17) returning to the non-deflected configuration with the relative peripheral edge (21) resting against the annular valve seat (25) (as shown in figure 2).

[0031] To control opening of the valve (16) it is sufficient to axially press on the spigot (10). Due to this force and the consequent advancement of the plunger (9) to the operative position against the elastic return imparted by the annular wall (8), the end wall (18) of the cup-shaped element (17) deforms in a completely similar manner to that previously described in reference to spontaneous opening.

[0032] The open state is then maintained until the spigot (10) is released. In this case, the plunger (9) is immediately returned to the retracted, inoperative position due to the return effect of the elastic wall (8) to the non-deformed starting position and the end wall (18) of the cup-shaped element (17) returns with its edge (21) in contact with the valve seat (25) to form a hermetic seal.

[0033] The embodiment illustrated in Figures 4-6 differs from that described above only in that the annular wall (8) has a rounded, substantially bell-shaped, external shape.

[0034] Naturally, the constructional details and the embodiments could be extensively changed with respect to that described and illustrated without leaving the scope of this invention. Thus, for example, a supplementary spring could be provided in addition to or in substitution of the annular wall (8).

[0035] In addition, although the valve has been described with express reference to an anti-siphon application, it could be also be easily adapted for use as a simple check valve with an opening control and preset for spontaneous opening at significantly smaller fluid pressure levels, e.g. 0.01 - 0.02 bar. Calibration can be effected by simply working on the elastic characteristics of the cup-shaped element (17), e.g. varying the thickness of its end wall (18), using materials of different hardness, or modifying the assembly preloading.

[0036] Finally, with regards to controlled opening, although the example illustrated in the drawings employs an axial push-down system, the external, manually induced deformation of the end wall (18) of the cup-shaped element (17) could also be effected using any type of equivalent system, e.g. such as a rotary system, even with motorised actuation.

[0037] The variant of the invention represented in figures 7-12 is generally similar to that previously described and only the differences will be described in detail, using the same numerical references for similar or identical parts.

[0038] In this variant, the first part (2) is externally formed with a pair of diametrically opposed, axial struts (7). Between the external struts (7), part 2 has an elastically sprung annular wall (8) of reduced thickness, which in turn is integrally moulded with a central cylindrical member (9) to form a control plunger.

[0039] Also in this case, the elastically sprung annular wall (8) constitutes an elastic member that tends to keep the plunger (9) in the retracted, inoperative position shown in figures 8, 10 and 11. The elastic wall (8) is elastically deformable to allow the plunger (9) to extend to the advanced, operative position shown in figure 12 when in controlled operation mode.

[0040] It should be noted that the elastic annular wall (8) could have a different shape than that shown in figure 4, e.g. with annular ribbing as represented in the variant shown in figure 11.

[0041] Externally, the second part (3) of the body of the valve (1) has a pair of projecting axial struts (27), arranged to be diametrical opposite the axial struts (7) of part 2, and forming with these a fork support (28). A transverse rotating shaft (29), also normally made of a moulded plastic material and carrying a control appendage (30) at one end and an axial retaining disc (31) at the other, is mounted on the fork support (28). The transverse shaft (29) is arranged with the central zone in contact with the spigot (10) of the plunger (9) and has a radial projection (32) in correspondence with this zone, forming a cam. On the opposite side, the shaft (29) has a longitudinal reinforcement rib (42).

[0042] By operating the control member (30), the shaft (29) can be turned from the position shown in figures 7-11, in which the cam (32) is staggered 90° with respect to the spigot (10) of the plunger (9), which is in the retracted, inoperative position, to the position shown in figure 12, in which the cam (32) holds the plunger (9) in the advanced operative position, with corresponding deformation of the elastic annular wall (8).

[0043] In operation, to open the valve it is sufficient to rotate the shaft (29) via the manual control (30) to the

position shown in figure 12. Due to this rotation and the consequent advancement of the plunger (9) to the operative position via the cam (32) contrasting the elastic return action of the annular wall (8), the end wall (18) of the cup-shaped element (17) deforms in a totally similar manner to that previously described in reference to spontaneous opening

[0044] The open state is thus maintained until the shaft (29) is turned back to the start position, as shown in figures 8, 10 and 11. In this case, the plunger (9) is returned to the retracted, inoperative position due to the return effect of the elastic wall (8) to the non-deformed starting position and the end wall (18) of the cup-shaped element (17) returns with its edge (21) in contact with the valve seat (25) to form a hermetic seal.

[0045] In this case as well, many functionally equivalent variants can be envisaged: for example, with regards to controlled opening, even though the example illustrated in the drawings uses a rotating cam system, the external, manually induced deformation of the end wall (18) of the cup-shaped element (17) could also be effected using any other type of equivalent system, such as a sliding cam, inclined planes, or even a motorised actuator.

[0046] The variant illustrated in figures 13 to 22 will now be described.

[0047] In this variant, item 1' indicates an axial fitting assembly for tube-to-tube connection in medical infusion lines and similar. It should be immediately noted that it could also be set up for Luer-tube, tube-Luer or Luer-Luer connections.

[0048] The fitting (1') is essentially composed of three components: a first tubular connector (2'), a second tubular connector (3') and an intermediate tubular element (4') that is rigidly fixed to the second tubular element (3') and on which the first tubular element (2') is mounted such that it can rotate.

[0049] The first tubular connector (2'), and the second tubular connector (3') are both normally constructed as single mouldings using a relatively rigid plastic material, such as polycarbonate or ABS, while the intermediate tubular element (4') is made as a single piece of a relatively less rigid plastic material, such as polyethylene, polypropylene, nylon or "vestodur". As it will appear evident in the following, the three components 2', 3' and 4' of the valve (1') are joined together using simple, irreversible snap couplings, without the need for additional mechanical connections. This evidently renders assembling of the valve (1') appreciably straightforward and economical.

[0050] The first tubular connector (2'), illustrated in greater detail in figure 19, defines an upstream passageway, or inlet passageway (5'), coaxially aligned with a downstream passageway, or outlet passageway (6'), in the form of the second tubular connector (3'): these passageways can be connected to the respective tubing sections of a medical infusion line and the like.

[0051] An anti-siphon valve, generically indicated as item 7' and described in greater detail in the following, is inserted between the upstream passageway (5') and the downstream passageway (6').

[0052] The first tubular connector (2'), illustrated in greater detail in figure 19, includes a peripheral, axial shell (8') formed with two diametrically opposed, radially elongated portions (9') respectively defining grip protuberances to facilitate valve opening and closing manoeuvres. Inside the peripheral shell (8'), the first tubular connector (2') has two axial appendages, in angular correspondence to the two grippers (9'), that are elastically sprung in the radial direction and, in turn, are equipped with ridges (11') radially projecting towards the inside and forming two cam-follower members, as will be seen in the following.

[0053] The portion of the upstream passageway (5') that faces the valve (7'), or rather the second tubular connector (3'), consists of a central, axial, tubular part (12') moulded integrally with the first tubular connector (2'), the extremity of which has a pair of diametrically opposed frontal recesses (17'), as shown in figure 19. As will be seen, the central tubular part (12') constitutes a plunger member cooperating with the valve (7'), with the former being able to move axially with respect to the latter due to the relative rotation between the first tubular connector (2') and the second tubular connector (3').

[0054] The cam-follower ridges (11') engage smoothly in their respective cam tracks (13'), which have a substantially helical shape and are formed in diametrically opposite positions on the outside of an axially extended, central portion (14') of the intermediate tubular element (4'). The tubular plunger (12') of the first tubular connector (2') is engaged via this central tubular portion (14'), around which it can turn, subject to friction. The rotary coupling with friction between the tubular plunger (12') and the central portion (14') is performed in a way that avoids leaks between their respective facing walls, i.e. it provides a dynamic fluid seal. This effect is produced by the fact that the central tubular portion (14') has a terminal annular section (15') with walls of reduced thickness and an internal, radial, annular enlargement (16') arranged to form a contact seal against the external surface of the tubular plunger (12'). The annular enlargement (16') is illustrated in greater detail in figure 22, where it is in the state immediately preceding the axial insertion of the tubular plunger (12') during assembling of the first tubular connector (2') and the intermediate tubular element (4'). This assembling is performed by the irreversible snap coupling of the cam-follower ridges (11') onto the relative cam tracks (13').

[0055] The intermediate element (4') has an annular base (18') with an internal circumferential groove (19') that engages, via a substantially irreversible axial snap coupling, on an annular rib (20') formed on the outside of the body (21') of the second tubular element (3').

[0056] Inside the base (18'), the second tubular element (3') has a short, integral, axial appendage (23') that, together with the body (21') of the second tubular

element (3'), delimits a chamber (24') for the valve (7'). This axial appendage (23') presents a conical surface (25') that defines an annular seat for the valve (7'). On the opposite side, the body (21') of the second tubular element (3') has a channelled surface (26'), coaxial to the outlet passageway (6') and formed by a halo of radial channels communicating with the outlet passageway (6') on one side and the respective axial channels (27') that laterally delimit the chamber (24') on the other. In addition, axial ridges (28'), the function of which will be explained in the following, are provided on the channelled surface (26') around the outlet passageway (6').

[0057] Reference numeral 29' indicates the shutter of the valve (7'). This shutter (29') is composed of cup-shaped elastic element, shown in the non-deformed state corresponding to the closed position of the valve (7') in figure 17, and in deformed state corresponding to the open position of the valve (7') in figure 18. This cup-shaped element (29') has a circular end wall (30') and a shell or side wall (31') with a cylindrical shape or, more suitably, a conical surface diverging towards the outlet passageway (6').

[0058] The end wall (30') can be of even thickness or, more suitably, be thicker towards its centre, as illustrated.

[0059] Similarly, the side wall (31') can be of even thickness or, more suitably, be thicker towards its free edge (32'), or rather the part furthest away from the end wall (30'), as illustrated.

[0060] The external circumferential edge (33') of the end wall (30') can be sharp, as in the case of the illustrated example, or rounded.

[0061] The cup-shaped element (29') is normally moulded as a single piece of soft elastic material, especially liquid silicone that is injection moulded using a central injection point.

[0062] The cup-shaped element (29') is coaxially housed inside the chamber (24') with its end wall (30') facing the inlet passageway (5') like a transversal diaphragm and resting against the end of the tubular plunger (12') with the recesses (17'). The side wall (31') of the cup-shaped element (29') faces the axial channels (27') with its free edge (32') resting against the channelled surface (26') of the second tubular element (3').

[0063] The external circumferential edge (33') of the end wall (30') of the cup-shaped element (29') cooperates with the annular valve seat (25') of the intermediate tubular element (4'). The arrangement is such that in the valve's closed position shown in figures 13, 15 and 17, the cup-shaped element (29') is subjected to a predetermined axial preloading: in this way the peripheral edge (33') of the end wall (30') is kept elastically pressed against the annular valve seat (25') by the axial force exerted by the side wall (31'), as well as the radial force applied by the end wall (30') due to the conical shape of the valve seat (25'), forming a seal. This condition corresponds to the normally closed position of the valve (7'), in which flow from the upstream passageway (5') to the downstream passageway (6') is prevented in an effective and safe manner. This normally closed position is visually identifiable by the angular alignment between the radial projections (9') of the first tubular connector (2') and the pair of corresponding reference projections (34') on the intermediate tubular element (4').

[0064] When an overpressure exceeding a predetermined threshold, in the range 1-5 psi for example, develops in the upstream passageway (5'), the anti-siphon valve (7') passes automatically and promptly from the closed state to the open state, shown in figure 18, due to flexion of the end wall (30') of the cup-shaped element (29'), possibly combined with partial, axial, elastic yielding of its side wall (31'). This flexion causes the peripheral edge (33') of the end wall (30') of the cup-shaped element (29') to move away from the annular valve seat (25'), producing an annular opening between them (35'), as shown in figure 18. The upstream passageway (5') is thus in connection with the downstream passageway (6') via the annular opening (35'), the axial channels (27') facing the side wall (31') of the cup-shaped element (29') and the radial channels of the channelled wall (26') of the second tubular connector (3').

[0065] As already stated, the spontaneous opening of the valve (7') occurs promptly even if the diaphragm formed by the end wall (30') of the cup-shaped element (29') is subjected to a relatively high axial preloading for assuring maximum safety and reliability in closure. In fact, the force imparted against the end wall (30') by the pressure when it reaches the threshold value causes its elastic deformation into an essentially concave hemispheric shape, resulting in the peripheral edge (33') separating from the conical-surface valve seat (25') with a certain amount of amplification. Therefore, in practice a modest pressure beyond the threshold level is sufficient to cause the immediate and rapid opening of the valve (7'), thus reducing any risks of undesired adherence between the edge (33') and the valve seat (25'), even after the valve (7') has been closed for prolonged periods.

[0066] In the open state of the valve (7'), as the fluid flow increases, the end wall (30') of the cup-shaped element (29') becomes proportionally more deformed and, in consequence, the annular opening (35') proportionally increases in size.

[0067] The function of the axial ridges (28') on the channelled surface (26') is to prevent the end wall (30') from blocking the outlet passageway (6') when it becomes deformed.

[0068] In addition, in the open state of the valve (7'), the force imparted by the fluid against the external surface in the zone of the side wall (31') of the cup-shaped element (29') next to its end wall (30') contributes to keeping the valve open.

[0069] The anti-siphon valve (7') immediately returns to the closed position when the pressure balance between the upstream passageway (5') and the downstream passageway (6') is re-established, or in the case of overpressure in the downstream passageway (6'),

due to the end wall (30') of the cup-shaped element (29') returning to the non-deflected configuration with the relative peripheral edge (33') resting against the annular valve seat (25'), as shown in figure 17.

[0070] To positively operate opening of the valve (7') it is sufficient to rotate the first tubular fitting (2') with respect to the intermediate tubular element (4'), or rather the first tubular fitting (2') with respect to the second tubular connector (3'), by manually turning the projections 9' and 34'. Due to this rotation, normally of approximately 90°, and the interaction between the cam-follower ridges (11') and the cam tracks (13') from the state shown in figures 13, 15 and 17 to that illustrated in figures 14, 16 and 18, the reciprocal helical motion between the first tubular fitting (2') and the intermediate element (4'), or rather between the first tubular fitting (2') and the second tubular connector (3'), causes the tubular plunger (12') to axially advance from the retracted, inoperative position towards the advanced operative position. In doing so, it axially presses the end wall (30') of the cup-shaped element (29') in the direction of the outlet passageway (6'). The end wall (30') is thus deformed in the same way as that previously described with reference to spontaneous opening.

[0071] The open state thus obtained is maintained until the first tubular fitting (2') is rotated with respect to the intermediate tubular element (4'), back to the starting position in figures 13, 15 and 17. In this case, the tubular plunger (12') is brought back to the retracted, inoperative position and the end wall (30') of the cup-shaped element (29') returns with its edge (33') in contact with the valve seat (25') to form a hermetic seal.

[0072] From the above description, it is evident that the system for moving the plunger (12') provides positive control for both opening and closing the valve (7') and that it allows the said tubular plunger (12') to be permanently held in either of the retracted or advanced positions.

[0073] It will also be appreciated that the manoeuvres for positively controlling opening and closing of the valve are practical and functional, and that assembling of the valve's component elements - effected via simple axial snap couplings - can be carried out in a relatively simple and economic manner and even using fully mechanised devices.

[0074] It should also be noted that the overall dimensions of the valve, or rather of the fitting (1') that incorporates it, are extremely small and in general are not greater than those of a similar connector with an anti-siphon valve that provides only spontaneous opening/closing.

[0075] Naturally, also in this case, the constructional details and the forms of realisation could be extensively changed with respect to that described and illustrated without departing from the scope of this invention, as defined in the appended Claims.

[0076] Thus, for example, the cam tracks (13') of the intermediate tubular element (4') could be arranged such that the reciprocal angular position between the manoeuvring protuberances (9') of the first tubular fitting (2') and the reference protuberances (34') of the intermediate tubular element (4') corresponds to that represented in figures 13 and 15 when the valve (7') is in the closed position and that shown in figures 14 and 16 corresponds instead to the open state of the valve (7').

[0077] In addition, although the valve has been described with express reference to anti-siphon applications, it could easily be adapted for use as a simple check valve with an opening control and a preset for spontaneous opening at significantly smaller fluid pressures, in the order of 0.01 - 0.02 bar for example. Calibration can be effected by simply working on the elastic characteristics of the cup-shaped element (29'), e.g. varying the thickness of its end wall (30'), using materials of different hardness, or modifying assembly preloading.

[0078] Finally, the cam system used for implementing controlled valve opening/closing could be substituted by any equivalent system, possibly with motorised actuation.

Claims

1. A check valve (1; 7') for medical infusion lines and the like, including a first and a second tubular element (5, 13; 2', 3'), defining an upstream passageway (6; 5') and a downstream passageway (14; 6'), a diaphragm (17; 30') of elastically deformable material transversely positioned between said first and a second tubular elements (5, 13; 2', 3') and acting as a fluid seal in combination with an annular valve seat (25; 25') to keep the said control valve normally closed, wherein a predetermined fluid pressure in the said upstream passageway (6; 5') causes flexion of the said diaphragm (17; 30') and the consequent opening of the valve (1; 7'), **characterised in that** the said diaphragm (17; 30') axially cooperates with a plunger member (9; 12') that can axially slide between a retracted, inoperative position and an advanced, operative position to cause the controlled flexion of the said diaphragm (17; 30'), and that the valve also includes manually operable control means (10; 11', 13') for positively moving the said plunger (9; 12') to the said operative position and hence cause the controlled flexion of the said diaphragm (17; 30').

2. A valve according to Claim 1, **characterized In that** the said annular valve seat is defined by a wall with a conical surface (25; 25') coaxial to the said downstream passageway (14; 6') and diverging towards the latter, and that the said diaphragm is constituted by the end wall (18; 30') of a cup-shaped element (17; 29'), the external peripheral edge (21; 33') of which is normally pressed against the said annular

valve seat (25; 25') to form a seal under the axial pressure exerted by the side wall (19; 31') of the said cup-shaped element (17; 29'); the flexion of the said end wall (18; 30') of the cup-shaped element (17; 29') produced in use by the said predetermined fluid pressure, or by manoeuvring the said control means (10; 11', 13'), causing radial contraction of the said external peripheral edge (21; 33') and its consequent separation from the said annular valve seat (25; 25').

3. A valve according to Claim 2, **characterized in that**:

- the said upstream passageway (6) is staggered in parallel with respect to the said downstream passageway (14),
- the said valve seat (25) and said diaphragm (18) are arranged coaxially with respect to the said downstream passageway (14),
- elastic means (8) are provided for maintaining the said plunger (9) in the said inoperative position, and
- the said control means (10) can be manually operated to set the said plunger (9) in the said operative position, against the action of the said elastic means (8), thereby causing the controlled flexion of the said diaphragm (18); the simple release of the said control means (10) allowing the immediate return of the valve (1) to the said closed position under the action of the said elastic means (8).

4. A valve according to Claim 3, **characterized in that** the said first and second tubular elements (5, 13) are each formed as a single piece with a respective first and second hollow body (2, 3), said hollow bodies (2, 3) being permanently coupled together to define a hermetically sealed chamber (15), containing the said diaphragm (18), the said annular valve seat (25) and the said plunger (9); the said chamber (15) being axially connected with the said downstream passageway (14) and laterally connected with the said upstream passageway (6).

5. A valve according to Claim 3, **characterized in that** the said control means are slidable.

6. A valve according to Claim 3, **characterized in that** the said elastic means (8) are integrally formed with the said plunger (9).

7. A valve according to Claim 4, **characterized in that** the said elastic means (8) are integrally formed with the said first hollow body (2).

8. A valve according to Claim 5, **characterized in that** the said elastic means are constituted by an elastically yielding annular wall (8) that interconnects the said plunger (9) with the said first hollow body (2) and hermetically seals the said chamber (15).

9. A valve according to Claim 8, **characterized in that** the said elastically yielding annular wall (8) is formed with annular ribbings.

10. A valve according to Claim 3, **characterized in that** the said plunger (9) is formed with axial recesses.

11. A valve according to Claim 3, **characterized in that** the said annular valve seat (25) is formed in an annular member (26) through which the said plunger (9) axially slides.

12. A valve according to Claim 2, **characterized in that** the said side wall (19) of the cup-shaped element (17) has a free edge (20) in contact with a channelled surface (22) of the said second tubular element (13), communicating with the said downstream passageway (14).

13. A valve according to Claim 2, **characterized in that** the said side wall (19) of the cup-shaped element (17) has a cylindrical surface.

14. A valve according to Claim 2, **characterized in that** the said side wall (19) of the cup-shaped element (17) has a conical surface diverging in the direction of the said downstream passageway (14).

15. A valve according to Claim 12, **characterized in that** the said channelled surface (22) has a halo of radial channels (23), each extending into a respective axial channel (24) facing the side wall (19) of the cup-shaped element (17).

16. A valve according to Claim 2, **characterized in that** the said the said cup-shaped element (17) is of variable thickness.

17. A valve according to Claim 2, **characterized in that** the said external peripheral edge (21) of the end wall (18) of the cup-shaped element (17) has a sharp edge.

18. A valve according to Claim 2, **characterized in that** the said cup-shaped element (17) is formed from a single piece of soft elastomeric material, namely liquid silicone that is injection moulded using a central injection point.

19. A valve according to Claim 1, **characterized in that** the said first and second tubular elements (5, 13) are set up for tube-tube, Luer-tube, tube-Luer or Luer-Luer connections on the said medical line.

20. A valve according to Claim 8, **characterized in that** the said elastically yielding annular wall (8) has a substantially bell-shaped form.

21. A valve according to Claim 2, **characterized in that**:

- the said upstream passageway (6) is staggered in parallel with respect to the said downstream passageway (14),
- the said valve seat (25) and said diaphragm (18) are arranged coaxially with respect to the said downstream passageway (14),
- elastic means (8) are provided for maintaining the said plunger (9) in the said inoperative position, and
- cam control means (29, 32) can be manually operated to set and maintain the said plunger (9) in the said operative position, thereby causing the controlled flexion of the said diaphragm (18).

22. A valve according to Claim 21, **characterized in that** the said first and second tubular elements (5, 13) are each formed as a single piece with a respective first and second hollow body (2, 3), said hollow bodies (2, 3) being permanently coupled together to define a hermetically sealed chamber (15), containing the said diaphragm (18), the said annular valve seat (25) and the said plunger (9); the said chamber (15) being axially connected with the said downstream passageway (14) and laterally connected with the said upstream passageway (6).

23. A valve according to Claim 21, **characterized in that** the said cam control means is rotary.

24. A valve according to Claim 22, **characterized in that** the said first and second hollow bodies (2, 3) are also equipped with integral axial appendages (7, 27) that form a fork support (28) on the outside of the said chamber (15) and that the said means of cam control includes a transverse shaft (29) that is supported in rotation by the said support fork (28); the said shaft (29) carrying a radial cam (32) that acts on the plunger (9) and is equipped with an actuating control (30).

25. A valve according to Claim 21, **characterized in that** the said elastic means (8) are integrally formed with the said plunger (9).

26. A valve according to Claim 21, **characterized in that** the said elastic means (8) are integrally formed with the said first hollow body (2).

27. A valve according to Claim 25, **characterized in that** the said elastic means are composed of an elastically yielding annular wall (8) that interconnects the said plunger (9) with the said first hollow body (2) and hermetically seals the said chamber (15).

28. A valve according to Claim 27, **characterized in that** the said elastically yielding annular wall (8) is moulded with annular ribbing.

29. A valve according to Claim 2, **characterized in that** the said control means (11', 13') include a manually controlled cam mechanism for positively setting and maintaining the said plunger (9) in either the inoperative or the operative positions.

30. A valve according to Claim 29, **characterized in that** the said plunger (12') is tubular.

31. A valve according to Claim 29, **characterized in that** the said first tubular element (2') and the said second tubular element (3') are movable relative to each other in a substantially helical motion, and that the first tubular element (2') is formed with external grips (9') for controlling the said helical motion, and that the said second tubular element (3') has integral external reference parts (34') that cooperate with the said manoeuvring parts (9') to visually indicate either the inoperative position or the operative position of the said plunger member (12').

32. A valve according to Claim 31, **characterized in that** the said plunger member (12') is integrally formed with the said first tubular element (2').

33. A valve according to Claim 32, **characterized in that** it includes a third tubular element (4') provided between the said first tubular element (2') and the said second tubular element (3'), the said third tubular element (4') being angularly engaged with respect to the said second tubular element (3') and the said first tubular element (2') being able to rotate with respect to the said third tubular element (4'); the said third tubular element having substantially helical, external cam tracks (13') in which the respective cam follower members (11') integrally formed on the said first tubular element (2') are slidably engaged.

34. A valve according to Claim 33, **characterized in that** the-said cam follower members consist of a pair of diametrically opposed, radial projections (11') that can be elastically opened out in the radial direction.

35. A valve according to Claim 34, **characterized in that** the said tubular plunger (12') is rotatably engaged through the said third tubular element (4') with sealing radial interference.

36. A valve according to Claim 35, **characterized in that** the said third tubular element (4') is made from a plastic material that is relatively less rigid than that of the said first and second tubular elements (2', 3') and is formed with a localised, internal, radial, annular enlargement (16') designed to provide said sealing radial interference.

37. A valve according to Claim 36, **characterized in that** the said annular valve seat (25') is integrally formed with the said third tubular element (4').

38. A valve according to Claim 37, **characterized in that** the said third tubular element (4') is also formed with a peripheral shell (18') that rigidly engages with the said second tubular element (3').

39. A valve according to Claim 38, **characterized in that** the said third tubular element (4') is mounted on the said second tubular element (3') via a substantially irreversible axial snap fit coupling (19', 20').

40. A valve according to Claim 39, **characterized in that** the said first tubular element (2') is mounted on the said third tubular element (4') via a substantially irreversible axial snap fit coupling (11', 13').

41. A valve according to Claim 37, **characterized in that** the said annular valve seat (25') is defined by a wall of the said third tubular element (4') with a conical surface that diverges towards the said second tubular element (3') and that the said diaphragm is composed of the end wall (30') of a cup-shaped element (29'), the external peripheral edge (33') of which is normally pressed against the said annular valve seat (25') to form a seal under the axial pressure exerted by the side wall (31') of the said cup-shaped element (29'); in operation, the flexion produced in the said end wall (30') of the cup-shaped element (29') by the said predetermined fluid pressure, or the movement of the plunger member (12') from the said retracted inoperative position to the said advanced operative position, causing radial contraction of the said external peripheral edge (33') and its consequent separation from the said annular valve seat (25').

42. A valve according to Claim 41, **characterized in that** the said side wall (31') of the cup-shaped element (29') has its own free edge (31') in contact with the a channelled surface (26') of the said second tubular element (3') that communicates with the said downstream passageway (6').

43. A check valve (1) for medical infusion lines and the like, including a first and a second tubular element (5, 13) that respectively define an axial upstream passageway (6) and an axial downstream passageway (14), a diaphragm (17) of elastically deformable material transversely positioned between said first and a second tubular elements (5, 13) and acting as a fluid seal in combination with an annular valve seat (25) to keep the said valve normally closed, wherein a predetermined fluid pressure in the said upstream passageway (6) causes flexion of the said diaphragm (18) and the consequent opening of the valve, **characterised in that**:

- the said upstream passageway (6) is staggered in parallel with respect to the said downstream passageway (14),
- the said valve seat (25) and said diaphragm (18) are arranged coaxially with respect to the said downstream passageway (14),
- the said diaphragm (18) coaxially rests on a plunger member (9) that can slide between a retracted, inoperative position and an advanced, operative position,
- elastic means (8) are provided for normally maintaining the said plunger (9) in the said inoperative position, and
- means of control (10) can be manually operated to set the said plunger (9) in the said operative position, against the action of the said elastic means (8), thereby causing the controlled flexion of the said diaphragm (18); the simple release of the said control means(10) allows the immediate return of the valve (1) to the said closed position under the action of the said elastic means (8).

44. A check valve (1) for medical infusion lines and the like, including a first and a second tubular element (5, 13) that respectively define an axial upstream passageway (6) and an axial downstream passageway (14), a diaphragm (17) of elastically deformable material transversely positioned between said first and a second tubular element (5, 13) and acting as a fluid seal in combination with an annular valve seat (25) to keep the said valve normally closed, wherein a predetermined fluid pressure in the said upstream passageway (6) causes flexion of the said diaphragm (18) and the consequent opening of the valve, **characterised in that**:

- the said upstream passageway (6) is staggered in parallel with respect to the said downstream passageway (14),
- the said valve seat (25) and said diaphragm (18) are arranged coaxially with respect to the said downstream passageway (14),
- the said diaphragm (18) coaxially rests on a plunger member (9) that can slide between a retracted, inoperative position and an advanced, operative position,

- elastic means (8) are provided for normally maintaining the said plunger (9) in the said inoperative position, and
- cam control mechanism (29, 32) can be manually operated to set the said plunger (9) in the said operative position, thereby causing the controlled flexion of the said diaphragm (18).

45. A check valve (7') for medical infusion lines and the like, including a first and a second tubular element (2', 3') mutually coaxial to each other and respectively defining an upstream passageway (5') and an downstream passageway (6'), a diaphragm (30') of elastically deformable material transversely positioned between said first and a second tubular elements (2', 3') and acting as a fluid seal in combination with an annular valve seat (25') to keep the said valve normally closed, wherein a predetermined fluid pressure in the said upstream passageway (5') causes flexion of the said diaphragm (30') and the consequent opening of the said valve (7'), **characterised in that** the said diaphragm (30') coaxially cooperates with a tubular plunger member (12') which is axially slidable between a retracted inoperative position and an advanced operative position to cause the controlled flexion of the said diaphragm (30'), and **in that** it also comprises cam control means (11', 13') manually operable to positively set and maintain the said plunger (12') in either the said inoperative position or the said operative position.

Patentansprüche

1. Rückschlagventil (1; 7') für medizinische Infusionsleitungen und dergleichen mit einem ersten und einem zweiten röhrenförmigen Element (5, 13; 2', 3'), das einen Zulaufkanal (6; 5') und einen Ablaufkanal (14; 6') definiert, einer Membran (17; 30') aus elastisch verformbarem Material, die transversal zwischen dem ersten und einem zweiten röhrenförmigen Element (5, 13; 2', 3') positioniert ist und als Fluidsperre in Verbindung mit einem Ringventilsitz (25; 25') wirkt, um das Steuerventil normalerweise geschlossen zu halten, wobei ein vorgegebener Fluiddruck in dem Zulaufkanal (6; 5') Biegen der Membran (17; 30') und nachfolgendes Öffnen des Ventils (1; 7') bewirkt, **dadurch gekennzeichnet, dass** die Membran (17; 30') mit einem Kolbenteil (9; 12') axial zusammenwirkt, welches Kolbenteil axial zwischen einer zurückgezogenen Ruheposition und einer vorgeschobenen Arbeitsposition gleiten kann, um das gesteuerte Biegen der Membran (17; 30') hervorzurufen, und dass das Ventil auch manuell bedienbare Steuermittel (10; 11', 13') zur positiven Bewegung des Kolbens (9; 12') in die Arbeitsposition aufweist und folglich das gesteuerte Biegen der Membran (17; 30') bewirkt.

2. Ventil nach Anspruch 1, **dadurch gekennzeichnet, dass** der Ringventilsitz durch eine Wand mit einer konischen Fläche (25; 25') definiert ist, die koaxial zu dem Ablaufkanal (14; 6') ist und sich in Richtung auf den letzteren erweitert, und dass die Membran aus der Endwand (18; 30') eines becherförmigen Elements (17; 29') besteht, dessen äußerer Umfangsrand (21; 33') normalerweise gegen den Ringventilsitz (25; 25') gepreßt wird, um bei dem axialem Druck, der von der Seitenwand (19; 31') des becherförmigen Elements (17; 29') ausgeübt wird, eine Sperre zu bilden, wobei das Biegen der Endwand (18; 30') des becherförmigen Elements (17; 29'), das beim Gebrauch durch den vorgegebenen Fluiddruck oder durch Betätigen der Steuermittel (10; 11', 13') erzeugt wird, eine radiale Kontraktion des äußeren Umfangsrandes (21; 33') und seine darauffolgende Trennung von dem Ringventilsitz (25; 25') herbeiführt.

3. Ventil nach Anspruch 2, **dadurch gekennzeichnet, dass**:

   der Zulaufkanal (6) in bezug auf den Ablaufkanal (14) parallel versetzt ist,
   der Ventilsitz (25) und die Membran (18) in bezug auf den Ablaufkanal (14) koaxial angeordnet sind,
   elastische Mittel (8) vorgesehen sind, um den Kolben (9) in der Ruheposition zu halten und die Steuermittel (10) manuell bedient werden können, um den Kolben (9) in die Arbeitsposition gegen die Wirkung der elastischen Mittel (8) zu bringen, wodurch eine gesteuerte Biegung der Membran (18) herbeigeführt wird; wobei das einfache Freigeben der Steuermittel (10) das unmittelbare Zurückkehren des Ventils (1) in die Schließposition unter Wirkung der elastischen Mittel (8) ermöglicht.

4. Ventil nach Anspruch 3, **dadurch gekennzeichnet, dass** die ersten und zweiten röhrenförmigen Elemente (5, 13) mit einem jeweiligen ersten und zweiten Hohlkörper (2, 3) einstückig gebildet sind, wobei die Hohlkörper (2, 3) dauerhaft aneinander gekuppelt sind, um eine dicht abgeschlossene Kammer (15) zu definieren, die die Membran (18), den Ringventilsitz (25) und den Kolben (9) enthält, wobei die Kammer (15) mit dem Ablaufkanal (14) axial verbunden ist und mit dem Zulaufkanal (6) lateral verbunden ist.

5. Ventil nach Anspruch 3, **dadurch gekennzeichnet, dass** das die Steuermittel gleitbar sind.

6. Ventil nach Anspruch 3, **dadurch gekennzeichnet, dass** die elastischen Mittel (8) integral mit dem Kolben (9) gebildet sind.

7. Ventil nach Anspruch 4, **dadurch gekennzeichnet, dass** die elestischen Mittel (8) integral mit dem ersten Hohlkörper (2) gebildet sind.

8. Ventil nach Anspruch 5, **dadurch gekennzeichnet, dass** die elastischen Mittel aus einer elastisch nachgebenden ringförmigen Wand (8) bestehen, die den Kolben (9) mit dem ersten Hohlkörper (2) verbindet und die Kammer (15) dicht verschließt.

9. Ventil nach Anspruch 8, **dadurch gekennzeichnet, dass** die elastisch nachgebende ringförmige Wand (8) mit ringförmigen Rippen ausgebildet ist.

10. Ventil nach Anspruch 3, **dadurch gekennzeichnet, dass** der Kolben (9) mit axialen Ausnehmungen gebildet ist.

11. Ventil nach Anspruch 3, **dadurch gekennzeichnet, dass** der Ringventilsitz (25) als ein ringförmiges Teil (26) ausgebildet ist, durch welches der Kolben (9) axial gleitet.

12. Ventil nach Anspruch 2, **dadurch gekennzeichnet, dass** die Seitenwand (19) des becherförmigen Elements (17) eine freie Kante (20) aufweist, die in Kontakt mit einer mit Kanälen versehenen Fläche (22) des zweiten röhrenförmigen Elements (13) ist und mit dem Ablaufkanal (14) in Verbindung steht.

13. Ventil nach Anspruch 2, **dadurch gekennzeichnet, dass** die Seitenwand (19) des becherförmigen Elements (17) eine zylindrische Fläche aufweist.

14. Ventil nach Anspruch 2, **dadurch gekennzeichnet, dass** die Seitenwand (19) des becherförmigen Elements (17) eine konische in Richtung des Ablaufkanals (14) sich erweiternde Fläche aufweist.

15. Ventil nach Anspruch 12, **dadurch gekennzeichnet, dass** die mit Kanälen versehene Fläche (22) ein Halo von Radialkanälen (23) aufweist, die sich jeweils in einen jeweiligen axialen Kanal (24) erstrecken, der auf die Seitenwand (19) des becherförmigen Elements (17) weist.

16. Ventil nach Anspruch 2, **dadurch gekennzeichnet, dass** das becherförmige Element (17) variierende Dicke aufweist.

17. Ventil nach Anspruch 2, **dadurch gekennzeichnet, dass** der äußere Umfangsrand (21) der Endwand (18) des becherförmigen Elements (17) eine scharfe Kante aufweist.

18. Ventil nach Anspruch 2, **dadurch gekennzeichnet, dass** das becherförmige Element (17) aus einem einzigen Stück aus weichem Elastomermaterial geformt ist, nämlich flüssigem Silikon, das unter Verwendung eines zentralen Einspritzpunktes spritzgeformt ist.

19. Ventil nach Anspruch 1, **dadurch gekennzeichnet, dass** die ersten und zweiten röhrenförmigen Elemente (5, 13) für Rohr-Rohr, Luer-Rohr, Rohr-Luer oder Luer-Luer-Verbindungen bei der medizinischen Leitung eingerichtet sind.

20. Ventil nach Anspruch 8, **dadurch gekennzeichnet, dass** die elastisch nachgebende ringförmige Wand (8) eine im wesentlichen glockenförmige Gestalt hat.

21. Ventil nach Anspruch 2, **dadurch gekennzeichnet, dass:**

    der Zulaufkanal (6) in bezug auf den Ablaufkanal (14) parallel versetzt ist,
    der Ventilsitz (25) und die Membran (18) in bezug auf den Ablaufkanal (14) koaxial angeordnet sind,
    elastische Mittel (8) vorgesehen sind, um den Kolben (9) in der Ruheposition zu halten und
    Nockensteuermittel (29, 32) manuell bedient werden können, zum Einstellen und Halten des Kolbens (9) in der Arbeitsposition, wodurch eine gesteuerte Biegung der Membran (18) herbeigeführt wird.

22. Ventil nach Anspruch 21, **dadurch gekennzeichnet, dass** die ersten und zweiten röhrenförmigen Elemente (5, 13) mit einem jeweiligen ersten und zweiten Hohlkörper (2, 3) einstückig gebildet sind, wobei die Hohlkörper (2, 3) dauerhaft aneinander gekuppelt sind, um eine dicht abgeschlossene Kammer (15) zu definieren, die die Membran (18), den Ringventilsitz (25) und den Kolben (9) enthält, wobei die Kammer (15) mit dem Ablaufkanal (14) axial verbunden ist und mit dem Zulaufkanal (6) lateral verbunden ist.

23. Ventil nach Anspruch 21, **dadurch gekennzeichnet, dass** die Nockensteuermittel rotierend sind.

24. Ventil nach Anspruch 22, **dadurch gekennzeichnet, dass** die ersten und zweiten Hohlkörper (2, 3) auch mit integralen axialen Fortsätzen (7, 27) ausgerüstet sind, die einen Gabelträger (28) an der Außenseite der Kammer (15) bilden, und dass die Mittel der Nockensteuerung eine Querwelle (29) aufweisen, die durch die Haltergabel (28) drehend gelagert ist, wobei die Welle (29) eine Radialnocke (32) trägt, die auf den Kolben (9) wirkt und mit einer Antriebssteuerung (30) ausgerüstet ist.

25. Ventil nach Anspruch 21, **dadurch gekennzeich-**

net, dass die elastischen Mittel (8) integral mit dem Kolben (9) ausgebildet sind.

26. Ventil nach Anspruch 21, **dadurch gekennzeichnet, dass** die elastischen Mittel (8) integral mit dem ersten Hohlkörper (2) ausgebildet sind.

27. Ventil nach Anspruch 25, **dadurch gekennzeichnet, dass** die elastischen Mittel aus einer elastisch nachgebenden ringförmigen Wand (8) bestehen, die den Kolben (9) mit dem ersten Hohlkörper (2) verbindet und die Kammer (15) luftdicht verschließt.

28. Ventil nach Anspruch 27, **dadurch gekennzeichnet, dass** die elastisch nachgebende ringförmige Wand (8) mit ringförmigen Rippen ausgebildet ist.

29. Ventil nach Anspruch 2, **dadurch gekennzeichnet, dass** die Steuermittel (11', 13') einen manuell gesteuerten Nockenmechanismus zum positiven Einstellen und Halten des Kolbens (9) entweder in den Ruhe- oder den Arbeitspositionen aufweisen.

30. Ventil nach Anspruch 29, **dadurch gekennzeichnet, dass** der Kolben (12') röhrenförmig ist.

31. Ventil nach Anspruch 29, **dadurch gekennzeichnet, dass** das erste röhrenförmige Element (2') und das zweite röhrenförmige Element (3') in bezug aufeinander in einer im wesentlichen Schraubenbewegung bewegbar sind und dass das erste röhrenförmige Element (2') mit äußeren Griffen (9') zur Steuerung dieser Schraubenbewegung ausgebildet ist, und dass das zweite röhrenförmige Element (3') intergrale äußere Referenzteile (34) hat, die mit den Betätigungsteilen (9') zusammenwirken, um entweder die Ruheposition oder die Arbeitsposition des Kolbenteils (12') visuell anzuzeigen.

32. Ventil nach Anspruch 31, **dadurch gekennzeichnet, dass** das Kolbenteil (12') integral mit dem ersten röhrenförmigen Element (2') ausgebildet ist.

33. Ventil nach Anspruch 32, **dadurch gekennzeichnet, dass** es ein drittes röhrenförmiges Element (4') enthält, das zwischen dem ersten röhrenförmigen Element (2') und dem zweiten röhrenförmigen Element (3') vorgesehen ist, wobei das dritte röhrenförmige Element (4') in bezug auf das zweite röhrenförmige Element (3') winkelmäßig eingreift und das erste röhrenförmige Element (2') in bezug auf das dritte röhrenförmige Element (4') drehen kann, das dritte röhrenförmige Element im wesentlichen schraubenförmige äußere Nockenführungen (13') aufweist, in welche die auf dem ersten röhrenförmigen Element (2') integral ausgebildeten jeweiligen Nockenfolgerteile (11') gleitbar eingreifen.

34. Ventil nach Anspruch 33, **dadurch gekennzeichnet, dass** die Nockenfolgerteile aus einem Paar von diametral entgegengesetzten radialen Vorsprüngen (11') bestehen, die in der radialen Richtung aufgeweitet werden können.

35. Ventil nach Anspruch 34, **dadurch gekennzeichnet, dass** der röhrenförmige Kolben (12') durch das dritte röhrenförmige Element (4') mit radialer Dichtwechselwirkung drehbar eingreift.

36. Ventil nach Anspruch 35, **dadurch gekennzeichnet, dass** das dritte röhrenförmige Element (4') aus Kunststoffmaterial hergestellt ist, welches relativ weniger starr ist als das der ersten und zweiten röhrenförmigen Elemente (2', 3'), und das mit einer lokalen, inneren, radialen ringförmigen Vergrößerung (16') ausgebildet ist, die so beschaffen ist, dass sie die radiale Dichtwechselwirkung erzeugt.

37. Ventil nach Anspruch 36, **dadurch gekennzeichnet, dass** der Ringventilsitz (25') integral mit dem dritte röhrenförmigen Element (4') ausgebildet ist.

38. Ventil nach Anspruch 37, **dadurch gekennzeichnet, dass** das dritte röhrenförmige Element (4') auch mit einem peripheren Mantel (18') ausgebildet ist, der starr mit dem zweiten röhrenförmigen Element (3') in Eingriff steht.

39. Ventil nach Anspruch 38, **dadurch gekennzeichnet, dass** das dritte röhrenförmige Element (4') an dem zweiten röhrenförmigen Element (3') über eine im wesentlichen irreversible axiale Schnappsitzkupplung (19', 20') angebracht ist.

40. Ventil nach Anspruch 39, **dadurch gekennzeichnet, dass** das erste röhrenförmige Element (2') an dem dritten röhrenförmigen Element (4') über eine im wesentlichen irreversible axiale Schnappsitzkupplung (11', 13') angebracht ist.

41. Ventil nach Anspruch 37, **dadurch gekennzeichnet, dass** der Ringventilsitz (25') durch eine Wand des dritten röhrenförmigen Elements (4') mit einer konischen Fläche definiert wird, die sich in Richtung auf das zweite röhrenförmige Element (3') erweitert, und dass die Membran aus der Endwand (30') eines becherförmigen Elements (29') besteht, dessen äußerer Umfangsrand (33') normalerweise gegen den Ringventilsitz (25') gepreßt wird, um bei dem axialem Druck, der von der Seitenwand (31') des becherförmigen Elements (29') ausgeübt wird, eine Sperre zu bilden, wobei in Arbeitsposition das Biegen, das an der Stirnwand (30') des becherförmigen Elements (29') durch den vorgegebenen Fluiddruck erzeugt wird, oder die Bewegung des Kolbenteils (12') aus der zurückgezogenen Ruheposition in die

vorgeschobene Arbeitsposition eine radiale Kontraktion des äußeren Umfangsrandes (33') und seine darauffolgende Trennung von dem Ringventilsitz (25') herbeiführt.

42. Ventil nach Anspruch 41, **dadurch gekennzeichnet, dass** die Seitenwand (31') des becherförmigen Elements (29') mit ihrer eigenen freien Kante (31') Kontakt mit einer mit Kanälen versehenen Fläche (26') des zweiten röhrenförmigen Elements (3') hat, die mit den Ablaufkanal (6') in Verbindung steht.

43. Rückschlagventil (1) für medizinische Infusionsleitungen und dergleichen mit einem ersten und einem zweiten röhrenförmigen Element (5, 13), das jeweils einen axialen Zulaufkanal (6) und einen axialen Ablaufkanal (14) definiert, einer Membran (17) aus elastisch verformbarem Material, die transversal zwischen dem ersten und einem zweiten röhrenförmigen Element (5, 13) positioniert ist und als Fluidsperre in Verbindung mit einem Ringventilsitz (25) wirkt, um das Ventil normalerweise geschlossen zu halten, wobei ein vorgegebener Fluiddruck in dem Zulaufkanal (6) Biegen der Membran (18) und nachfolgendes Öffnen des Ventils bewirkt, **dadurch gekennzeichnet, dass**:

der Zulaufkanal (6) in bezug auf den Ablaufkanal (14) parallel versetzt ist,
der Ventilsitz (25) und die Membran (18) in bezug auf den Ablaufkanal (14) koaxial angeordnet sind,
die Membran (18) koaxial auf einem Kobenteil (9), das von einer zurückgezogenen Ruheposition in eine vorgeschobene Arbeitsposition gleiten kann, ruht,
elastische Mittel (8) vorgesehen sind, um den Kolben (9) in der Ruheposition zu halten und
Steuermittel (10) manuell bedient werden können, um den Kolben (9) in die Arbeitsposition gegen die Wirkung der elastischen Mittel (8) zu bringen, wodurch eine gesteuerte Biegung der Membran (18) herbeigeführt wird; das einfache Freigeben der Steuermittel (10) das unmittelbare Zurückkehren des Ventils (1) in die Schließposition unter Wirkung der elastischen Mittel (8) ermöglicht.

44. Rückschlagventil (1) für medizinische Infusionsleitungen und dergleichen mit einem ersten und einem zweiten röhrenförmigen Element (5, 13), das jeweils einen axialen Zulaufkanal (6) und einen axialen Ablaufkanal (14) definiert, einer Membran (17) aus elastisch verformbarem Material, die transversal zwischen dem ersten und einem zweiten röhrenförmigen Element (5, 13) positioniert ist und als Fluidsperre in Verbindung mit einem Ringventilsitz (25) wirkt, um das Ventil normalerweise geschlossen zu halten, wobei ein vorgegebener Fluiddruck in dem Zulaufkanal (6) Biegen der Membran (18) und nachfolgendes Öffnen des Ventils bewirkt, **dadurch gekennzeichnet, dass**:

der Zulaufkanal (6) in bezug auf den Ablaufkanal (14) parallel versetzt ist,
der Ventilsitz (25) und die Membran (18) in bezug auf den Ablaufkanal (14) koaxial angeordnet sind,
die Membran (18) koaxial auf einem Kolbenteil (9), das von einer zurückgezogenen Ruheposition in eine vorgeschobene Arbeitsposition gleiten kann, ruht,
elastische Mittel (8) vorgesehen sind, um den Kolben (9) in der Ruheposition zu halten und
Nockensteuermittel (29, 32) manuell bedient werden können, zum Einstellen des Kolbens (9) in die Arbeitsposition, wodurch eine gesteuerte Biegung der Membran (18) herbeigeführt wird.

45. Rückschlagventil (7') für medizinische Infusionsleitungen und dergleichen mit einem ersten und einem zweiten röhrenförmigen Element (2', 3'), die gegenseitig koaxial zueinander sind und jeweils einen Zulaufkanal (5') und einen Ablaufkanal (6') definieren, einer Membran (30') aus elastisch verformbarem Material, die transversal zwischen dem ersten und einem zweiten röhrenförmigen Element (2', 3') positioniert ist und als Fluidsperre in Verbindung mit einem Ringventilsitz (25') wirkt, um das Ventil normalerweise geschlossen zu halten, wobei ein vorgegebener Fluiddruck in dem Zulaufkanal (5') Biegen der Membran (30') und nachfolgendes Öffnen des Ventils (7') bewirkt, **dadurch gekennzeichnet, dass** die Membran (30') mit einem Kolbenteil (12') koaxial zusammenwirkt, welches Kolbenteil axial zwischen einer zurückgezogenen Ruheposition und einer vorgeschobenen Arbeitsposition gleitbar ist, um das gesteuerte Biegen der Membran (30') hervorzurufen, und dass das Ventil auch manuell bedienbare Nockensteuermittel (11', 13') zum positiven Einstellen und Halten des Kolbens (12') entweder in der Ruheposition oder in der Arbeitsposition aufweist.

Revendications

1. Clapet de retenue (1 ; 7') pour conduite d'injection médicale et analogue, comprenant un premier et un second élément tubulaire (5, 13 ; 2', 3') délimitant un passage amont (6 ; 5') et un passage aval (14 ; 6'), un diaphragme (17 ; 30') d'un matériau élastiquement déformable disposé transversalement entre le premier et le second élément tubulaire (5, 13 ; 2', 3') et agissent comme joint d'étanchéité aux flui-

des en combinaison avec un siège annulaire d'obturateur (25 ; 25') de manière que l'obturateur de commande soit maintenu en position normalement fermée, dans lequel une pression prédéterminée du fluide dans le passage amont (6 ; 5') provoque une flexion du diaphragme (17 ; 30') et l'ouverture correspondante de l'obturateur (1 ; 7'), **caractérisé en ce que** le diaphragme (17 ; 30) coopère axialement avec un organe plongeur (9 ; 12') qui peut coulisser axialement entre une position reculée de repos et une position avancée de travail en provoquant une flexion réglés du diaphragme (17 ; 30'), et **en ce que** l'obturateur comporte aussi un dispositif de commande manuelle (10 ; 11', 13') destiné à déplacer positivement le plongeur (9 ; 12') vers la position de travail et à provoquer ainsi une flexion réglés du diaphragme (17 ; 30').

2. Clapet selon la revendication 1, **caractérisé en ce que** le siège annulaire d'obturateur est délimité par une paroi ayant une surface conique (25 ; 25') coaxiale au passage avant (14 ; 6') et divergeant vers ce dernier, et **en ce que** le diaphragme est constitué par la paroi d'extrémité (18 ; 30') d'un élément en forme de cuvette (17 ; 29'), le bord périphérique externe (21 ; 33') de celui-ci étant normalement repoussé contre le siège annulaire d'obturateur (25 ; 25') pour la formation d'un joint étanche sous l'action de la pression axiale appliquée par la paroi latérale (19 ; 31') de l'élément en forme de cuvette (17 ; 29'), la flexion de la paroi d'extrémité (18 ; 30') de l'élément en forme de cuvette (17 ; 29') étant produite pendant l'utilisation par la pression prédéterminée du fluide ou par la manoeuvre du dispositif de commande (10 ; 11', 13') et provoquant une contraction radiale du bord périphérique externe (21 ; 33') et sa séparation concomitante du siège annulaire d'obturateur (25 ; 25').

3. Clapet selon la revendication 2, **caractérisé en ce que** :

   le passage amont (6) est décelé parallèlement au passage aval (14),
   le siège d'obturateur (25) et le diaphragme (18) sont placés coaxialement par rapport au passage aval (14),
   un dispositif élastique (8) est destiné à maintenir le plongeur (9) en position de repos, et
   le dispositif de commande (10) peut être commandé manuellement afin qu'il place le plongeur (9) en position de travail malgré l'action du dispositif élastique (8) et provoque ainsi une flexion réglée du diaphragme (18), la simple libération du dispositif de commande (10) provoquant le retour immédiat de l'obturateur (1) vers la position fermée sous l'action du dispositif élastique (8).

4. Clapet selon la revendication 3, **caractérisé en ce que** les premier et second éléments tubulaires (5, 13) sont formés chacun en une seule pièce avec un premier et un second corps creux respectif (2, 3), les corps creux (2, 3) étant couplés de façon permanente l'un à l'autre afin qu'ils délimitent une chambre hermétiquement fermée (15) qui contient le diaphragme (18), le siège annulaire d'obturateur (25) et le plongeur (9), cette chambre (15) étant raccordée axialement au passage aval (14) et étant raccordée latéralement au passage amont (6).

5. Clapet selon la revendication 3, **caractérisé en ce que** le dispositif de commande est coulissant.

6. Clapet selon la revendication 3, **caractérisé en ce que** le dispositif élastique (8) est formé en une seule pièce avec le plongeur (9).

7. Clapet selon la revendication 4, **caractérisé en ce que** le dispositif élastique (8) est formé en une seule pièce avec le premier corps creux (2).

8. Clapet selon la revendication 5, **caractérisé en ce que** le dispositif élastique est constitué par une paroi annulaire (8) qui peut fléchir élastiquement et qui relie le plongeur (9) au premier corps creux (2) et ferme hermétiquement la chambre (15).

9. Clapet selon la revendication 8, **caractérisé en ce que** la paroi annulaire (8) qui fléchit élastiquement est réalisée avec des arêtes annulaires.

10. Clapet selon la revendication 3, **caractérisé en ce que** le plongeur (9) est formé avec des cavités axiales.

11. Clapet selon la revendication 3, **caractérisé en ce que** le siège annulaire d'obturateur (25) est formé dans un organe annulaire (26) par lequel coulisse axialement le plongeur (9).

12. Clapet selon la revendication 2, **caractérisé en ce que** la paroi latérale (19) de l'élément en forme de cuvette (17) a un bord libre (20) au contact d'une surface canalisée (22) du second élément tubulaire (13), en communication avec le passage aval (14).

13. Clapet selon la revendication 2, **caractérisé en ce que** la paroi latérale (19) de l'élément en forme de cuvette (17) a une surface cylindrique.

14. Clapet selon la revendication 2, **caractérisé en ce que** la paroi latérale (19) de l'élément en forme de cuvette (17) a une surface conique qui diverge dans la direction du passage aval (14).

15. Clapet selon la revendication 12, **caractérisé en ce**

que la surface canalisée (22) possède un cercle de canaux radiaux (23) qui s'étendent chacun dans un canal axial respectif (24) tourné vers la paroi latérale (19) de l'élément en forme de cuvette (17).

16. Clapet selon la revendication 2, **caractérisé en ce que** l'élément en forme de cuvette (17) a une épaisseur variable.

17. Clapet selon la revendication 2, **caractérisé en ce que** le bord périphérique externe (21) de la paroi d'extrémité (18) de l'élément en forme de cuvette (17) a un bord net.

18. Clapet selon la revendication 2, **caractérisé en ce que** l'élément en forme de cuvette (17) est formé en une seule pièce d'un matériau élastomère souple, tel qu'une silicone liquide moulée par injection à l'aide d'une pointe centrale d'injection.

19. Clapet selon la revendication 1, **caractérisé en ce que** les premier et second éléments tubulaires (5, 13) sont réalisés pour permettre des connexions tube-tube, raccord Luer-tube, tube-raccord Luer ou raccord Luer-raccord Luer sur la conduite médicale.

20. Clapet selon la revendication 8, **caractérisé en ce que** la paroi annulaire (8) qui fléchit élastiquement a pratiquement une forme de cloche.

21. Clapet selon la revendication 2, **caractérisé en ce que** :

    le passage amont (6) est décalé parallèlement au passage aval (14),
    le siège d'obturateur (25) et le diaphragme (18) sont disposés coaxialement par rapport au passage aval (14),
    un dispositif élastique (8) est destiné à maintenir le plongeur (9) dans la position de repos, et un dispositif (29, 32) de commande à came peut être manoeuvré manuellement pour le montage et le maintien du plongeur (9) en position de travail, provoquant ainsi la flexion réglée du diaphragme (18).

22. Clapet selon la revendication 21, **caractérisé en ce que** les premier et second éléments tubulaires (5, 13) sont formés chacun en une seule pièce avec un premier et un second corps creux respectif (2, 3), les corps creux (2, 3) étant couplés de façon permanente afin qu'ils délimitent une chambre hermétique (15) qui contient le diaphragme (18), le siège annulaire de clapet (25) et le plongeur (9), la chambre (15) étant raccordée axialement au passage aval (14) et étant raccordée latéralement au passage amont (6).

23. Clapet selon la revendication 21, **caractérisé en ce que** le dispositif de commande à came est rotatif.

24. Clapet selon la revendication 22, **caractérisé en ce que** les premier et second corps creux (2, 3) sont aussi équipés d'accessoires axiaux solidaires (7, 27) qui forment un support de fourche (28) à l'extérieur de la chambre (15), et **en ce que** le dispositif de commande à came comporte un arbre transversal (29) supporté afin qu'il puisse tourner par la fourche de support (28), l'arbre (29) portant une came radiale (32) qui agit sur le plongeur (9) et est équipée d'uns commande de manoeuvre (30).

25. Clapet selon la revendication 21, **caractérisé en ce que** le dispositif élastique (8) est formé solidairement avec le plongeur (9).

26. Clapet selon la revendication 21, **caractérisé en ce que** le dispositif élastique (8) est formé en une seule pièce avec le premier corps creux (2).

27. Clapet selon la revendication 25, **caractérisé en ce que** le dispositif élastique est composé d'une paroi annulaire (8) qui peut fléchir élastiquement et qui raccorde le plongeur (9) au premier corps creux (2) et ferme la chambre (15) hermétiquement.

28. Clapet selon la revendication 27, **caractérisé en ce que** la paroi annulaire (8) qui fléchit élastiquement est moulée avec des arêtes annulaires.

29. Clapet selon la revendication 2, **caractérisé en ce que** le dispositif de commande (11', 13') comporte un mécanisme à came commandé manuellement et destiné à régler et maintenir positivement le plongeur (9) en position de repos ou de travail.

30. Clapet selon la revendication 29, **caractérisé en ce que** le plongeur (12') est tubulaire.

31. Clapet selon la revendication 29, **caractérisé en ce que** le premier élément tubulaire (2') et le second élément tubulaire (3') sont mobiles l'un par rapport à l'autre suivant un mouvement pratiquement en hélice, et **en ce que** le premier élément tubulaire (2') est formé avec des organes externes de saisie (9') destinés au réglage du mouvement en hélice, et **en ce que** le second élément tubulaire (3') a des parties externes solidaires de référence (34') qui coopèrent avec les parties de manoeuvre (9') pour indiquer visuellement la position de repos ou la position de travail de l'organe plongeur (12').

32. Clapet selon la revendication 31, **caractérisé en ce que** l'organe plongeur (12') est formé en une seule pièce avec le premier élément tubulaire (2').

33. Clapet selon la revendication 32, **caractérisé en ce qu'**il comprend un troisième élément tubulaire (4') placé entre le premier élément tubulaire (2') et le second élément tubulaire (3'), le troisième élément tubulaire (4') coopérant angulairement avec le second élément tubulaire (3') et le premier élément tubulaire (2') pouvant tourner par rapport au troisième élément tubulaire (4'), le troisième élément tubulaire ayant des voies externes (13') de came pratiquement en hélice dans lesquelles peuvent coulisser les organes respectifs (11') de toucheau de came formés en une seule pièce sur le premier élément tubulaire (2').

34. Clapet selon la revendication 33, **caractérisé en ce que** les organes de toucheau de came sont constitués d'une paire de saillies radiales diamétralement opposées (11') qui peuvent être écartées élastiquement dans la direction radiale.

35. Clapet selon la revendication 34, **caractérisé en ce que** le plongeur tubulaire (12') coopère de façon rotative par l'intermédiaire du troisième élément tubulaire (4') avec un coincement radial d'étanchéité.

36. Clapet selon la revendication 35, **caractérisé en ce que** le troisième élément tubulaire (4') est formé de matière plastique relativement moins rigide que la matière des premier et second éléments tubulaires (2', 3') et est formé avec un élargissement annulaire radial interne localisé (16') destiné à donner l'ajustement radial d'étanchéité.

37. Clapet selon la revendication 36, **caractérisé en ce que** le siège annulaire d'obturateur (25') est formé en une seule pièce avec le troisième élément tubulaire (4').

38. Clapet selon la revendication 37, **caractérisé en ce que** le troisième élément tubulaire (4') est aussi formé avec une paroi périphérique (18') qui coopère rigidement avec le second élément tubulaire (3').

39. Clapet selon la revendication 38, **caractérisé en ce que** le troisième élément tubulaire (4') est monté sur le second élément tubulaire (3') par l'intermédiaire d'un accouplement axial à enclenchement élastique pratiquement irréversible (19', 20').

40. Clapet selon la revendication 39, **caractérisé en ce que** le premier élément tubulaire (2') est monté sur le troisième élément tubulaire (4') par l'intermédiaire d'un accouplement axial par enclenchement élastique pratiquement irréversible (11', 13').

41. Clapet selon la revendication 37, **caractérisé en ce que** le siège annulaire d'obturateur (25') est délimité par une paroi du troisième élément tubulaire (4') qui a une surface conique qui diverge vers le second élément tubulaire (3'), et **en ce que** le diaphragme est composé de la paroi d'extrémité (30') d'un élément en forme de cuvette (29') dont le bord périphérique externe (33') est normalement poussé contre le siège annulaire d'obturateur (25') pour former un joint étanche sous l'action de la pression axiale exercée par la paroi latérale (31') de l'élément en forme de cuvette (29') et, pendant le fonctionnement, la flexion produite dans la paroi d'extrémité (30') de l'élément en forme de cuvette (29') par la pression prédéterminée du fluide ou le déplacement de l'organe plongeur (12') depuis sa position reculée de repos vers sa position avancée de travail provoque la contraction radiale du bord périphérique externe (33') et sa séparation concomitante du siège annulaire d'obturateur (25').

42. Clapet selon la revendication 41, **caractérisé en ce que** la paroi latérale (31') de l'élément en forme de cuvette (29') a son propre bord libre (31') au contact d'une surface canalisée (26') du second élément tubulaire (3') qui communique avec le passage aval (6').

43. Clapet de retenue (1) pour conduite d'injection médicale ou analogue, comprenant un premier et un second élément tubulaire (5, 13) qui délimitant respectivement un passage amont axial (6) et un passage aval axial (14), un diaphragme (17) d'un matériau élastiquement déformable positionné transversalement entre les premier et second éléments tubulaires (5, 13) et agissant comme joint étanche aux fluides en combinaison avec un siège annulaire d'obturateur (25) afin que le clapet soit maintenu normalement fermé, dans lequel une pression prédéterminés de fluide dans le passage amont (6) provoque une flexion du diaphragme (18) et l'ouverture concomitante du clapet, **caractérisé en ce que** :

le passage amont (6) est décalé en parallèle avec le passage aval (14),
le siège d'obturateur (25) et le diaphragme (18) sont disposés coaxialement au passage aval (14),
le diaphragme (18) est en appui coaxial sur un organe à plongeur (9) qui peut coulisser entre une position reculée de repos et une position avancée de travail,
un dispositif élastique (8) est destiné à maintenir normalement le plongeur (9) en position de repos, et
un dispositif (10) de commande peut être manoeuvré manuellement pour placer le plongeur (9) en position de travail, malgré l'action du dispositif élastique (8), en provoquant ainsi une flexion réglée du diaphragme (18), la simple li-

bération du dispositif de commande (10) permettant le retour immédiat de l'obturateur (1) vers sa position de fermeture sous l'action du dispositif élastique (8).

44. Clapet de retenue (1) pour conduites d'injection médicale ou analogues, comprenant un premier et un second élément tubulaire (5, 13) qui délimitant respectivement un passage axial amont (6) et un passage axial aval (14), un diaphragme (17) d'un matériau élastiquement déformable positionné transversalement entre les premier et second éléments tubulaires (5, 13) et agissant comme joint d'étanchéité aux fluides en combinaison avec un siège annulaire d'obturateur (25) afin que le clapet soit maintenu en position normalement fermée, dans lequel une pression prédéterminée de fluide dans le passage amont (6) provoque une flexion du diaphragme (18) et l'ouverture correspondante du clapet, **caractérisé en ce que** :

le passage amont (6) est décalé en direction parallèle par rapport au passage aval (14),
le siège d'obturateur (25) et le diaphragme (18) sont disposés coaxialement par rapport au passage aval (14),
le diaphragme (18) est coaxialement en appui sur un organe plongeur (9) qui peut coulisser entre une position reculée de repos et une position avancée de travail,
un dispositif élastique (8) est destiné à maintenir normalement le plongeur (9) dans sa position de repos, et
un mécanisme de commande de came (29, 32) peut être manoeuvré manuellement afin qu'il mette le plongeur (9) dans la position de fonctionnement et provoque ainsi une flexion réglée du diaphragme (18).

45. Clapet de retenue (7') pour conduites d'injection médicale ou analogues, comprenant un premier et un second élément tubulaire (2', 3') coaxiaux mutuellement et délimitant respectivement un passage amont (5') et un passage aval (6'), un diaphragme (30') d'un matériau élastiquement déformable étant positionné transversalement entre les premier et second éléments tubulaires (2', 3') et agissant comme joint d'étanchéité aux fluides en combinaison avec un siège annulaire d'obturateur (25') afin que le clapet soit maintenu en position normalement fermés, dans lequel une pression prédéterminée du fluide dans le passage amont (5') provoque un fléchissement du diaphragme (30') et une ouverture correspondante du clapet (7'), **caractérisé en ce que** le diaphragme (30') coopère coaxialement avec un organe tubulaire de plongeur (12') qui peut coulisser axialement entre une position reculée de repos et une position avancée de travail afin que la flexion réglée du diaphragme (30') soit provoquée, et **en ce qu'**il comporte en outre un dispositif de commande à came (11', 13') qui peut être commandé manuellement pour régler et maintenir positivement le plongeur (12') en position de repos ou en position de travail respectivement.

Fig_1

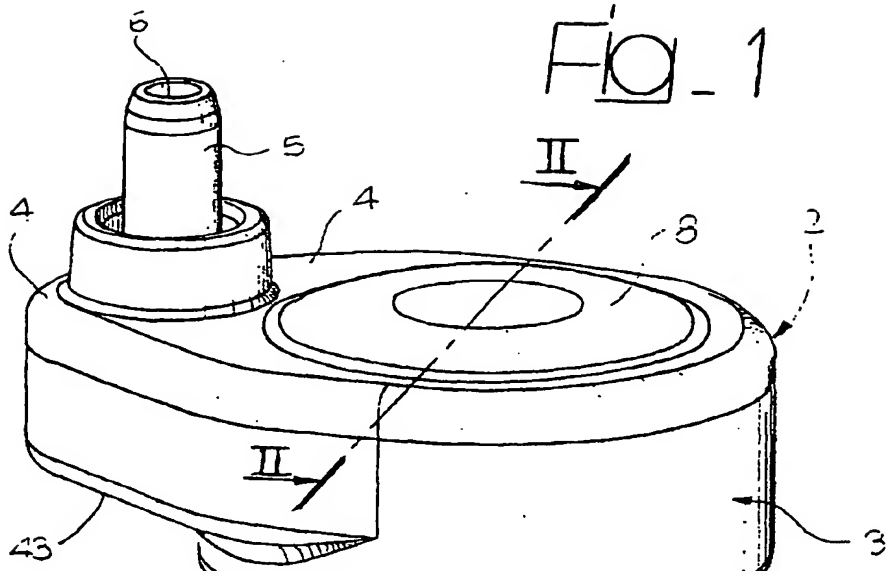

Fig_4

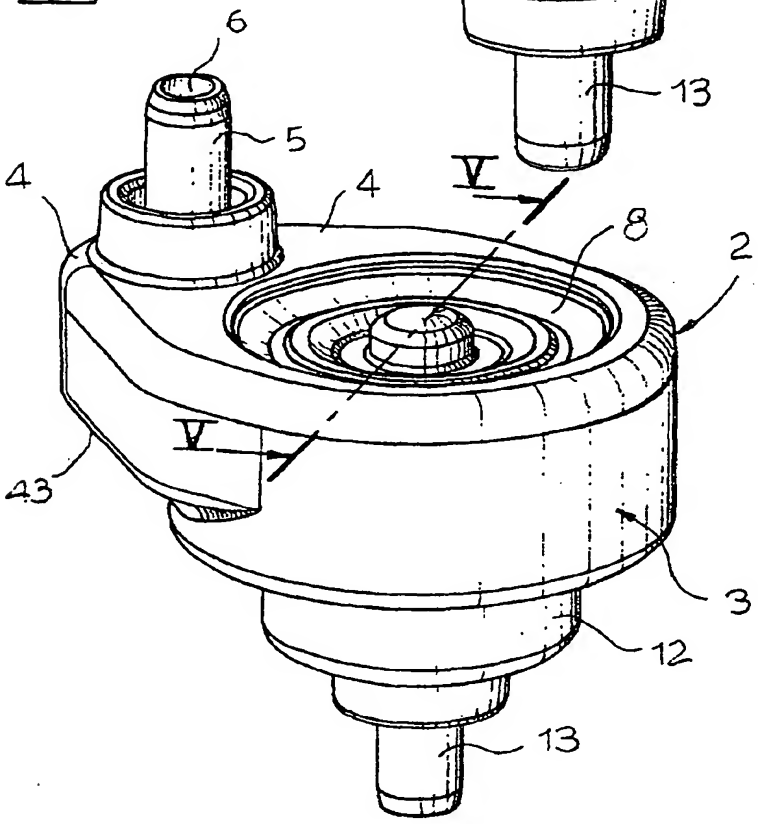

Fig_2

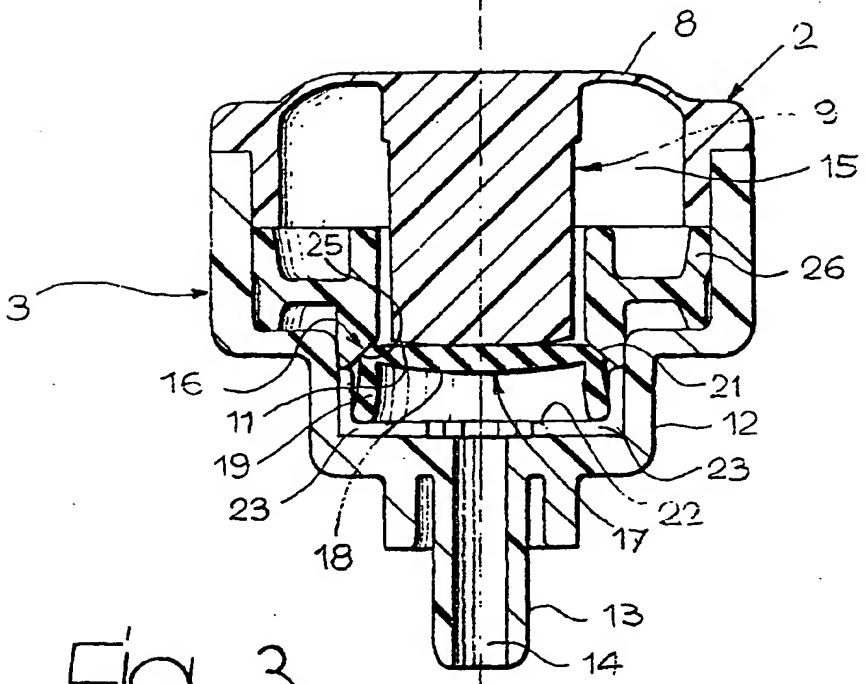
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Fig_3

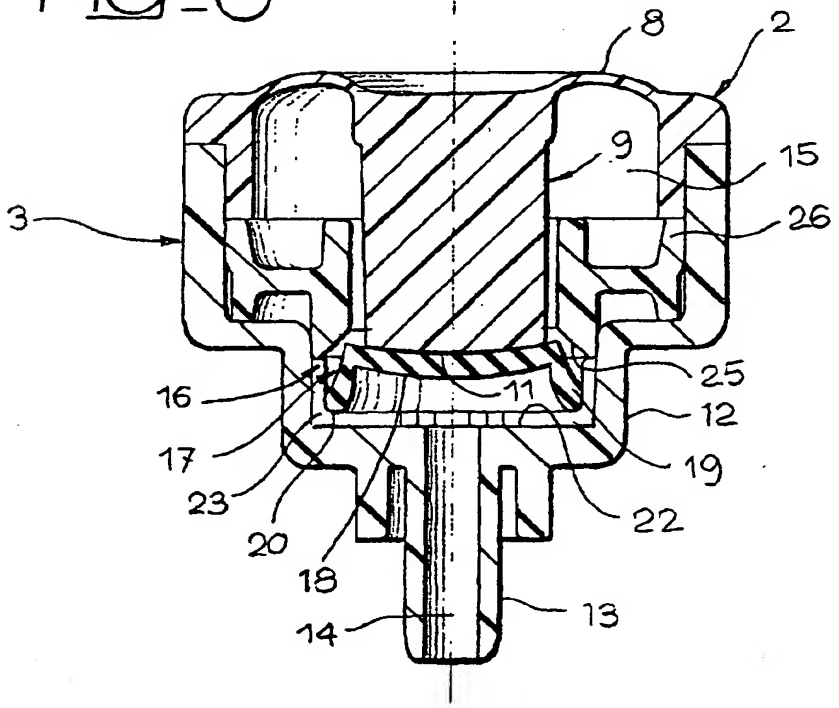
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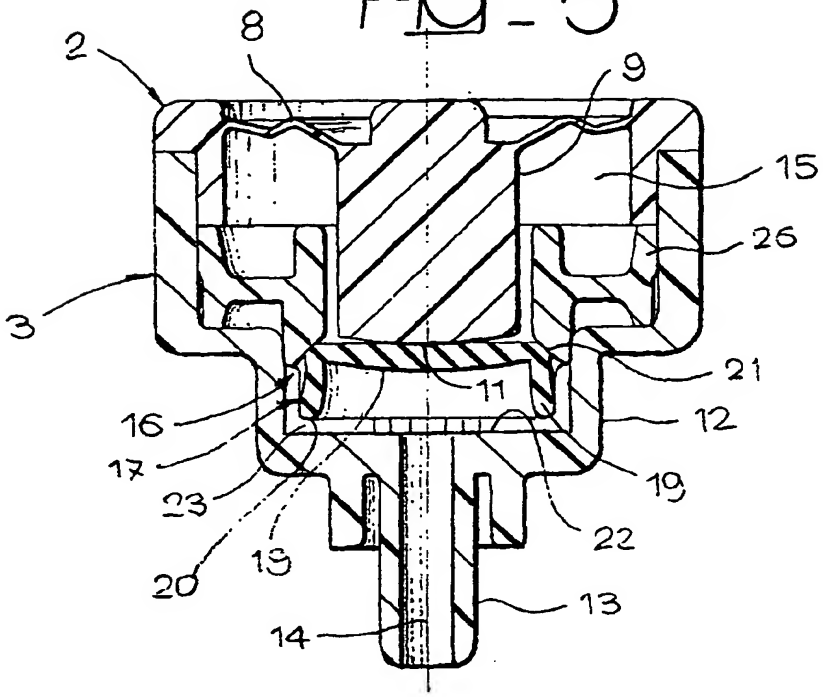
Fig_5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18
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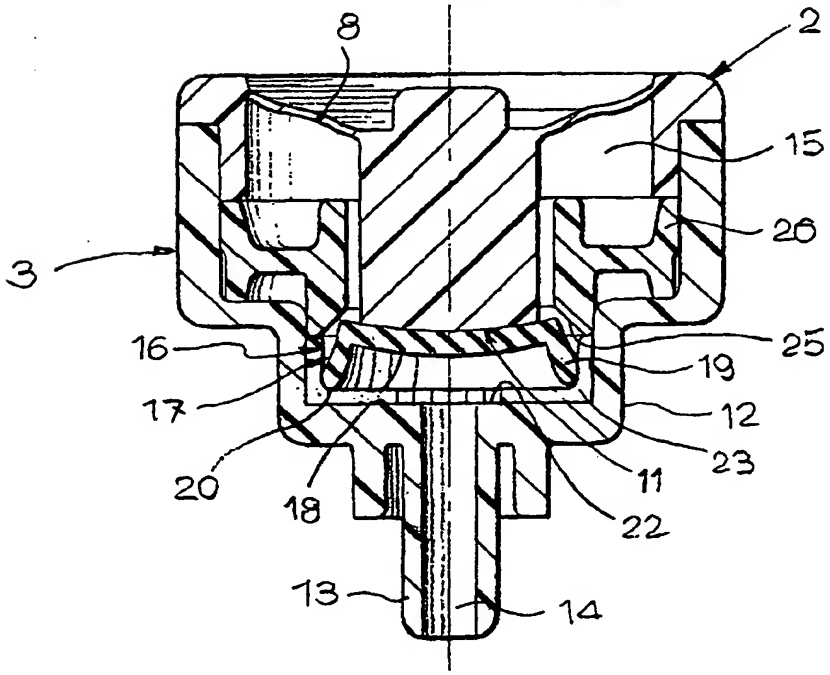
14

Fig_6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12
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11
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18
22
13
14

Fig_7

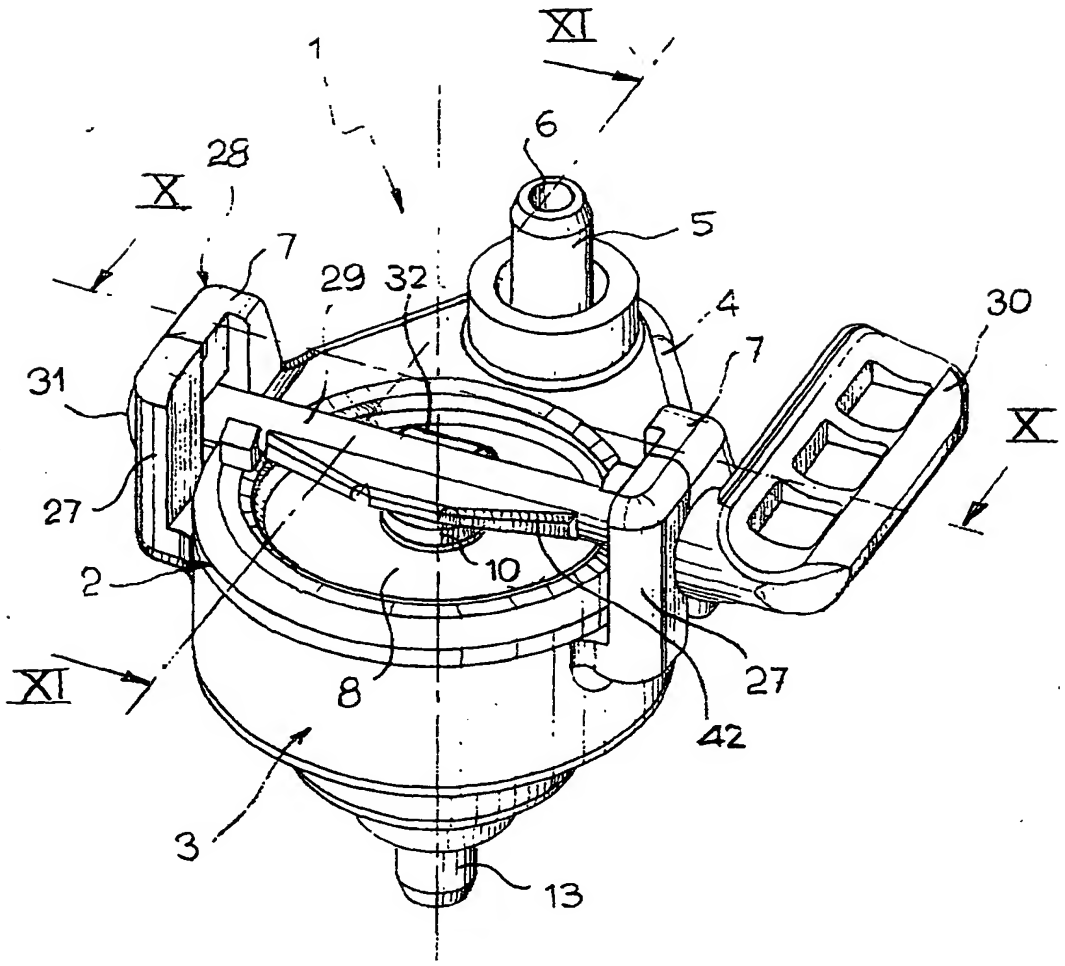

Fig. 8

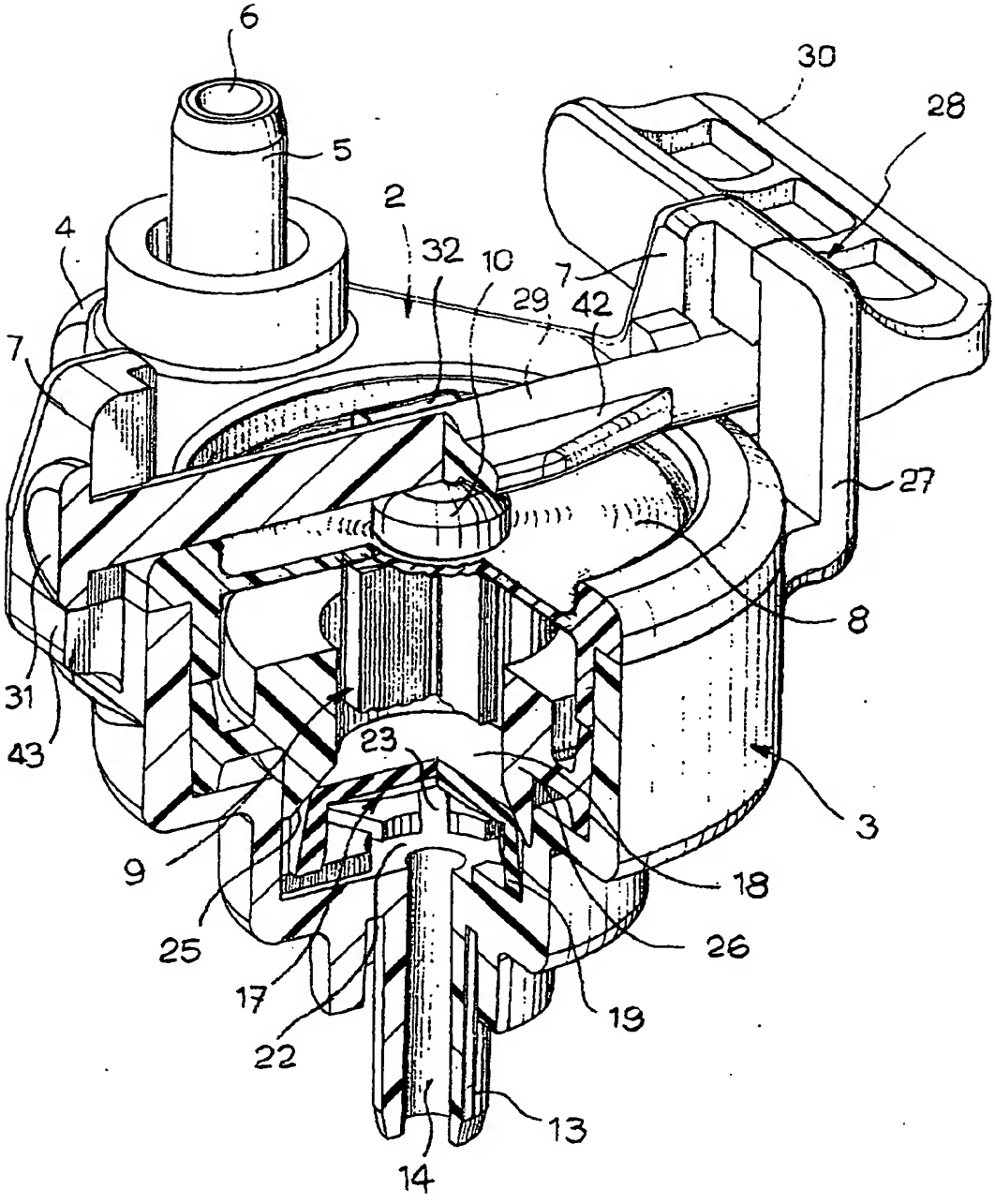

Fig_9

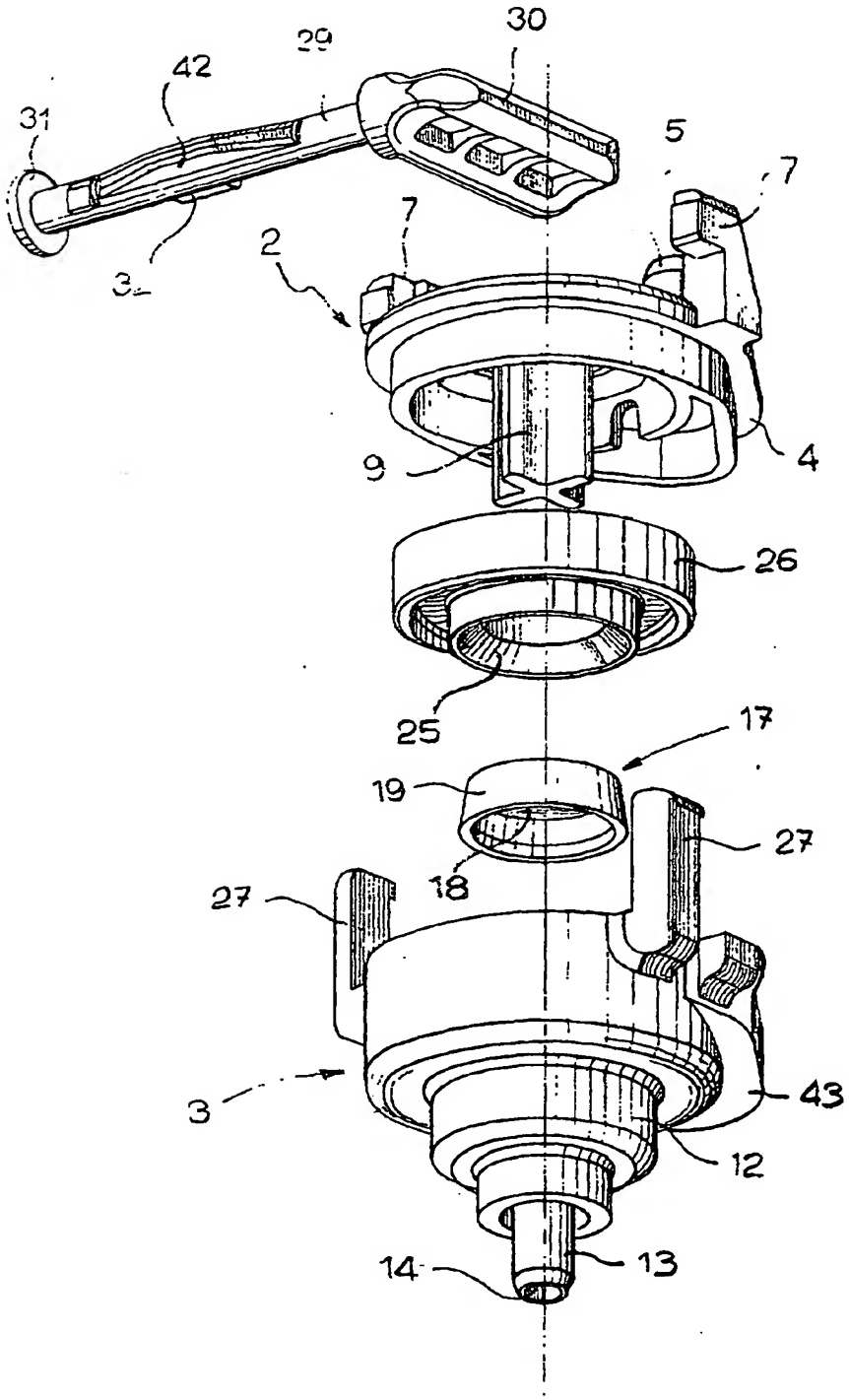

Fig_10

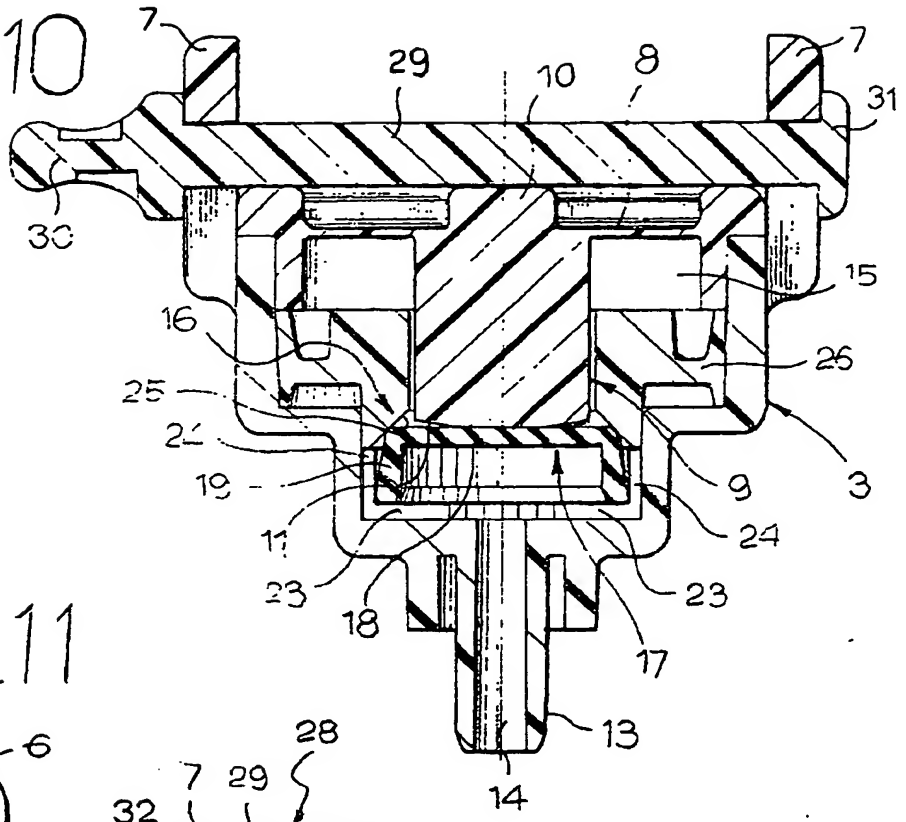
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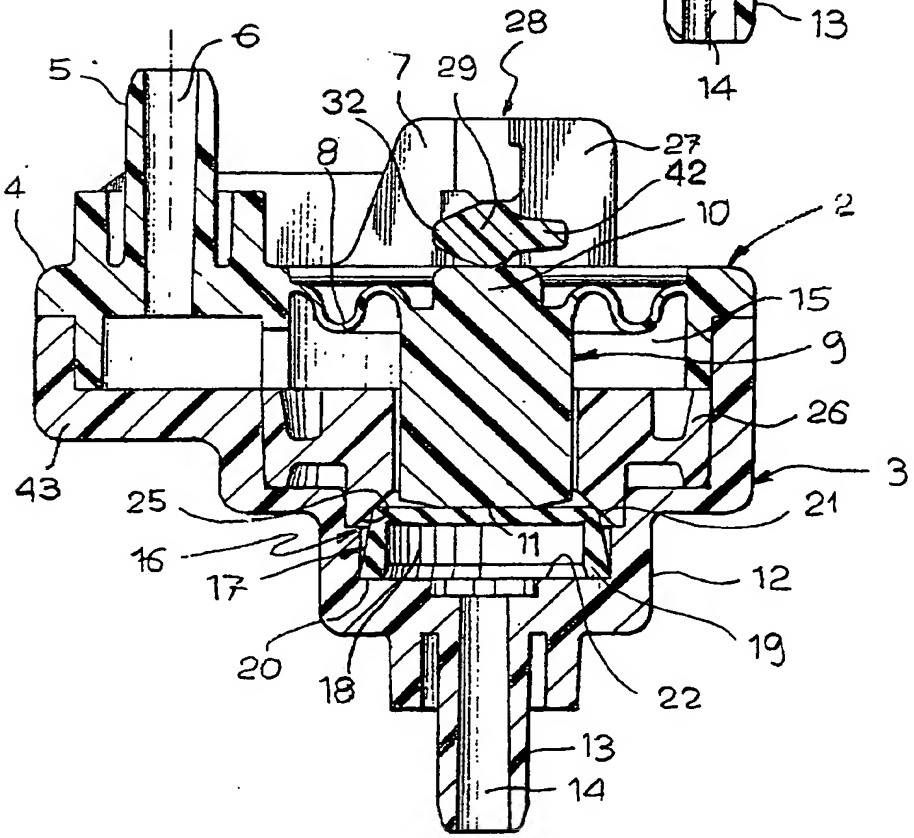
Fig_11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29
32
8
27
42
4
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13
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Fig.12

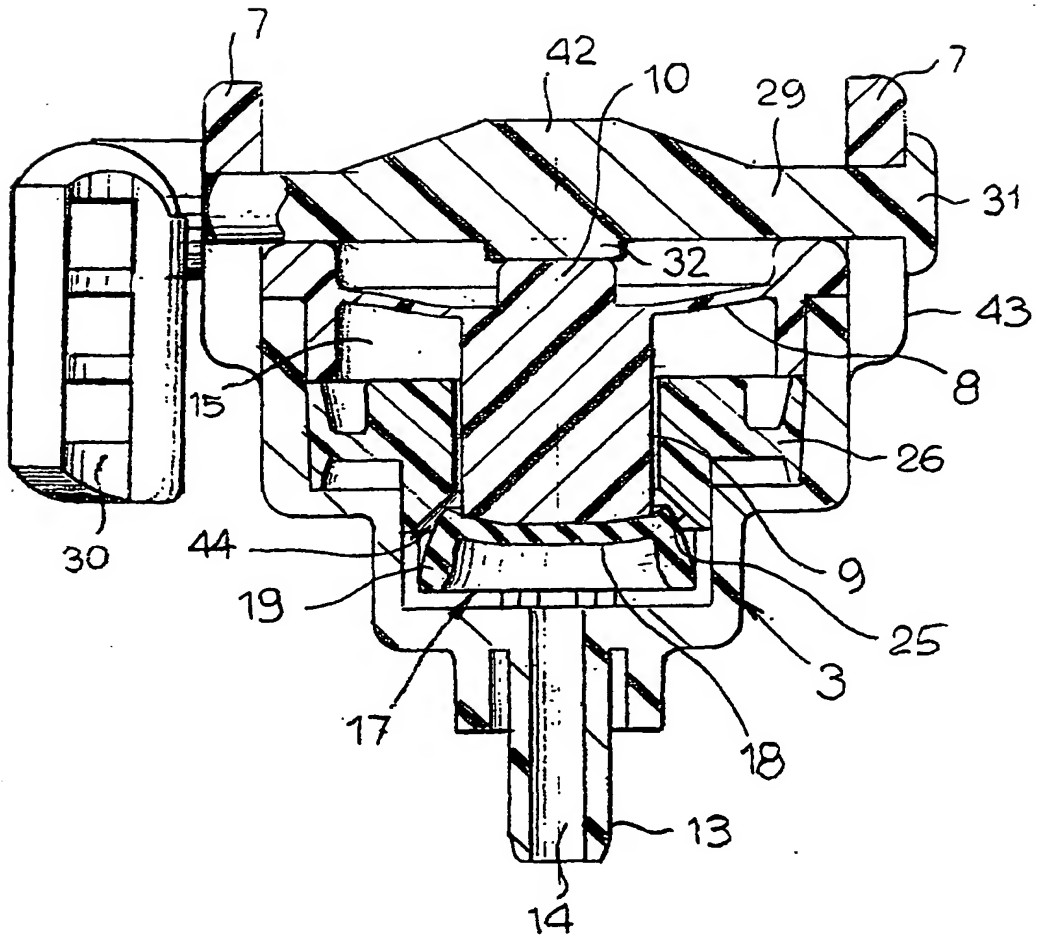

Fig. 13

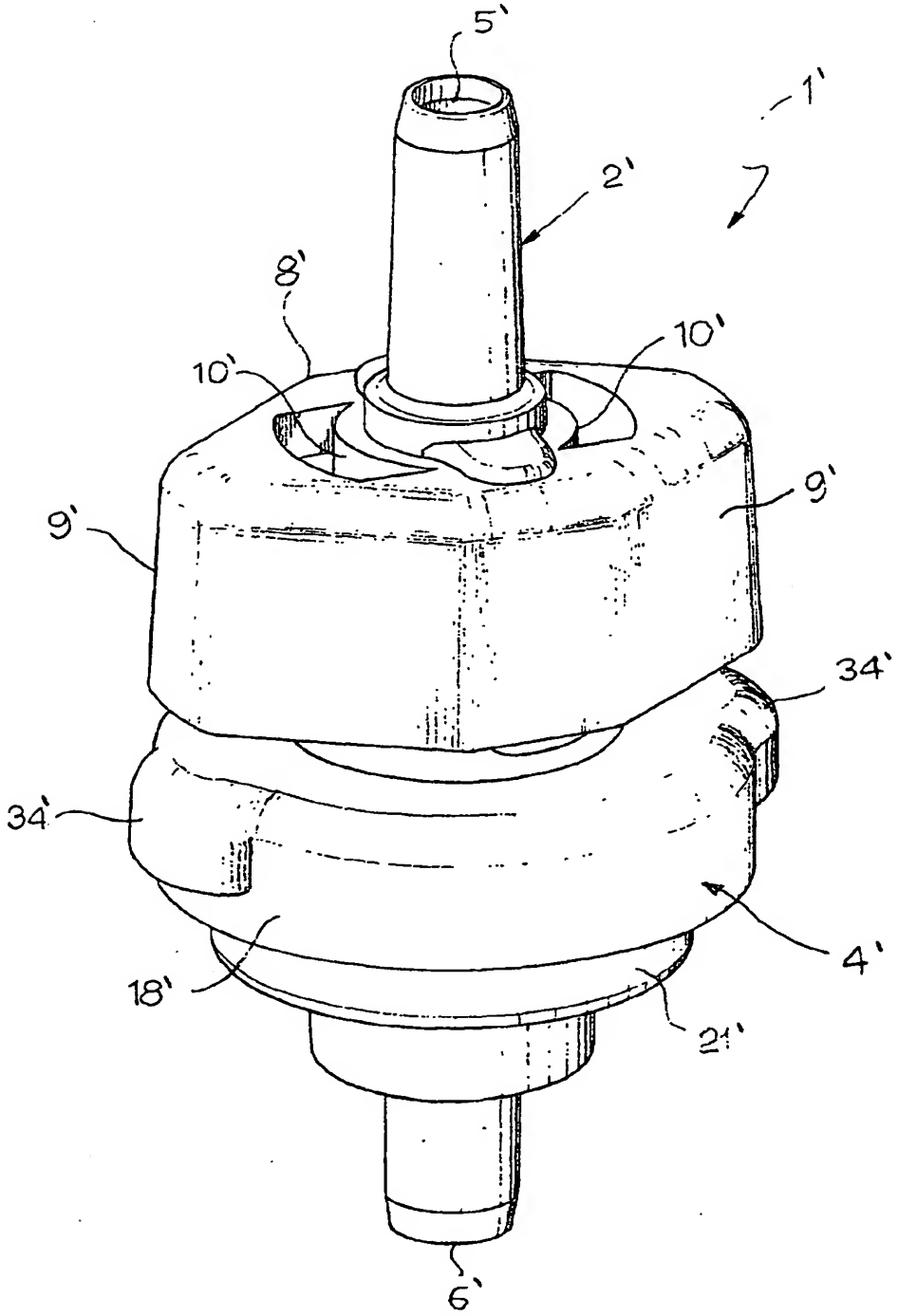

Fig_14

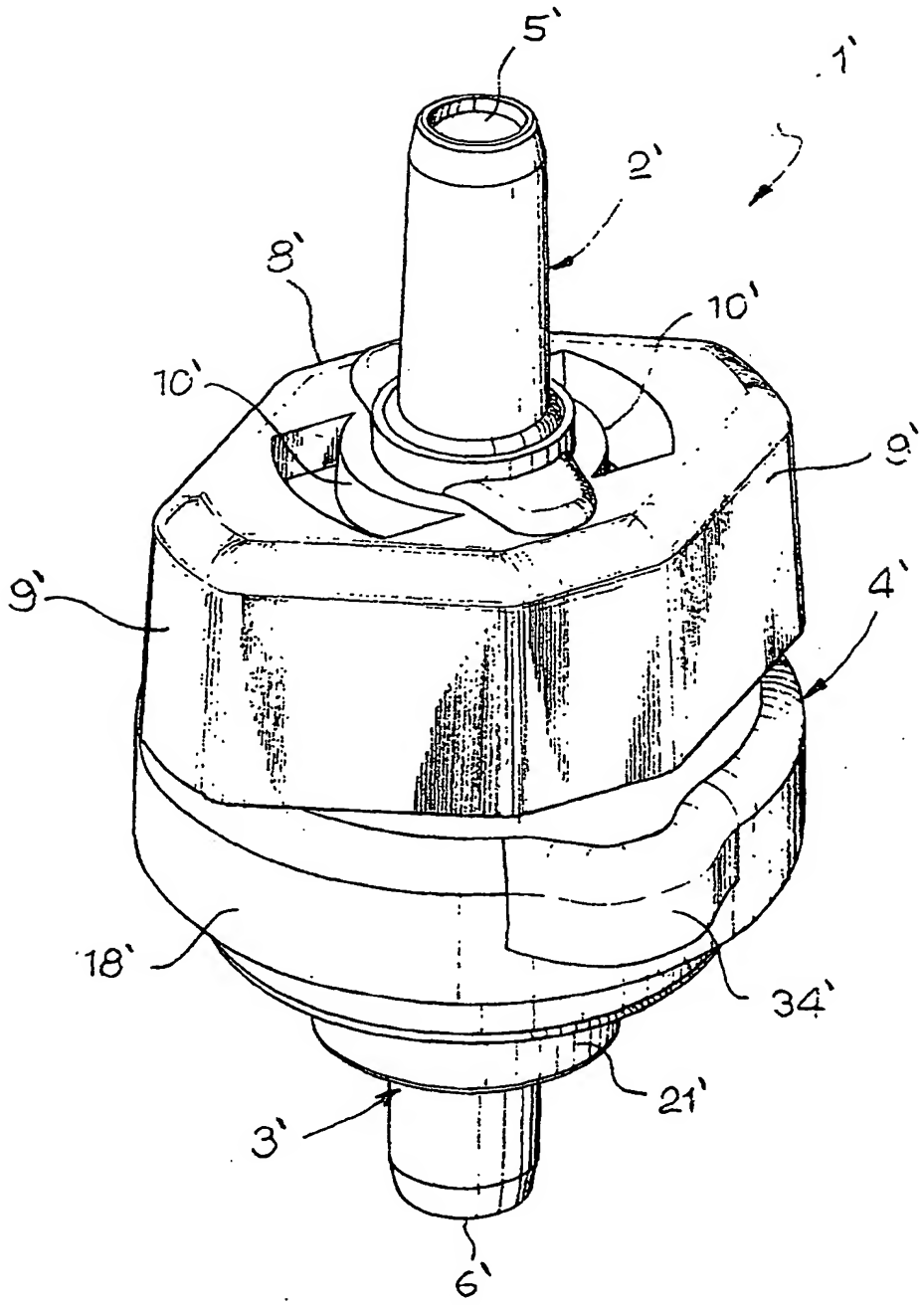

FIG-16

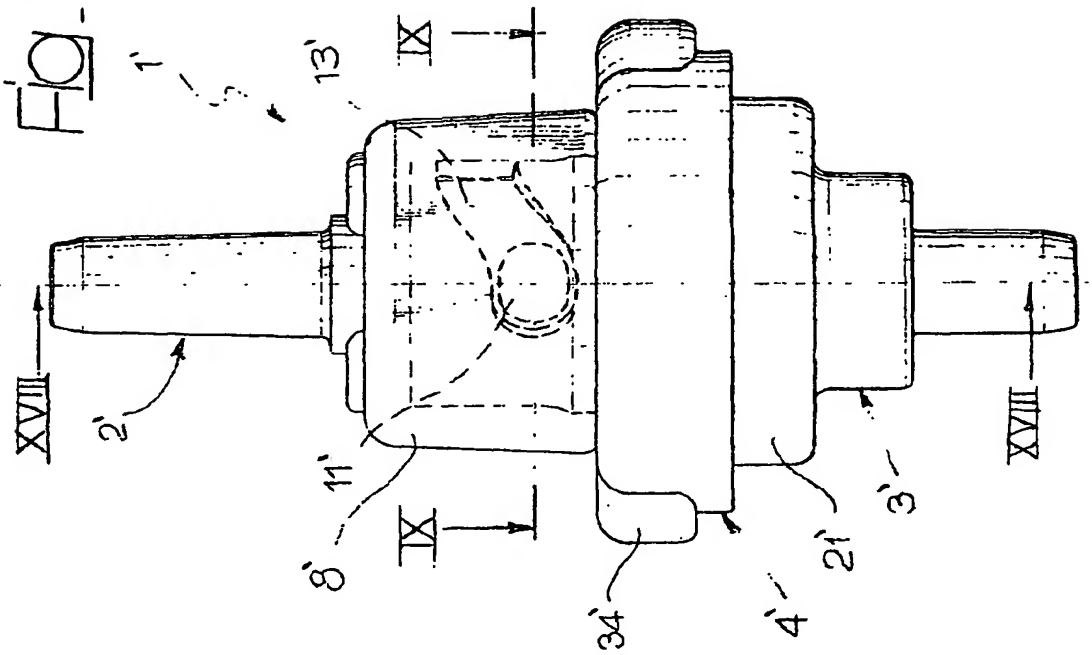
1'
13'
IX
IX
XVIII
XVIII
2'
11'
8'
34'
4'
21'
3'

FIG-15

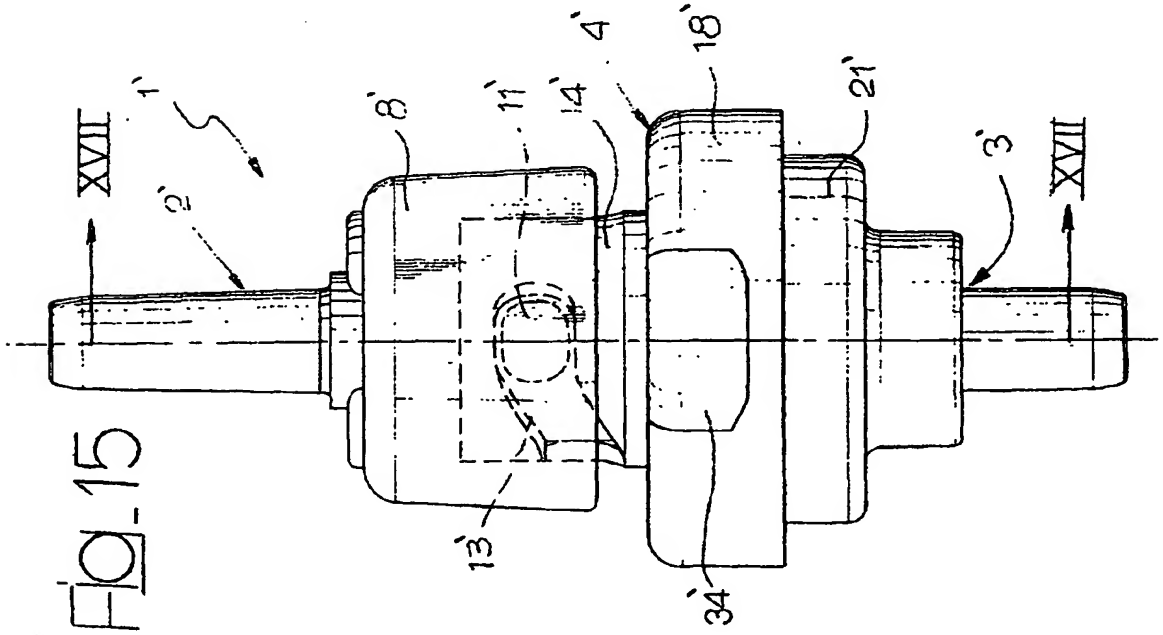
XVII
XVII
1'
2'
8'
11'
14'
4'
18'
21'
3'
13'
34'

FIG_18

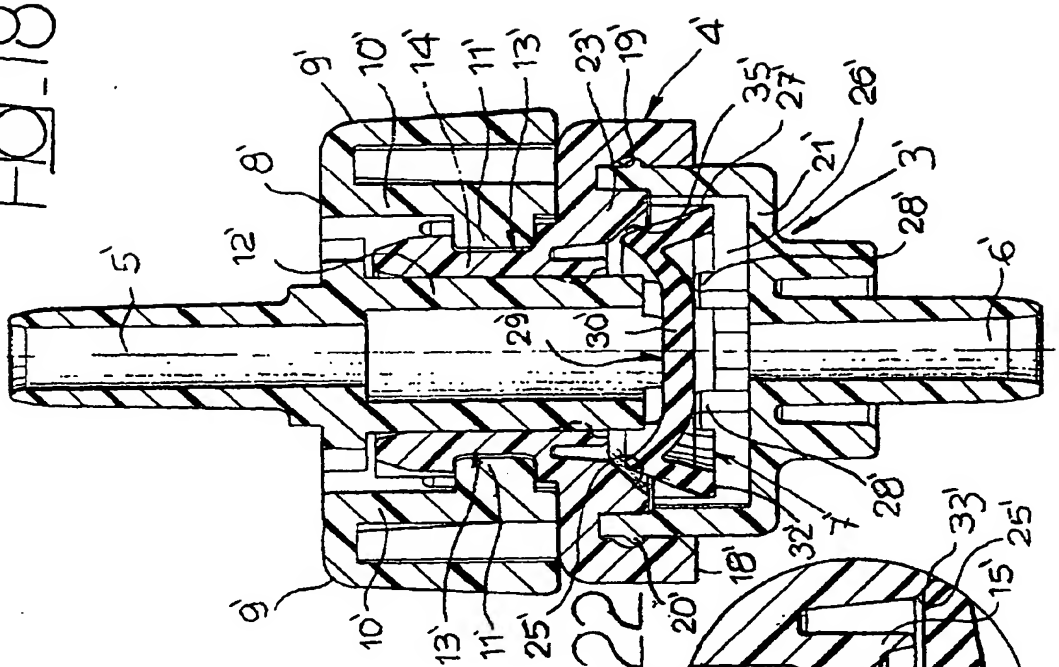

FIG_22

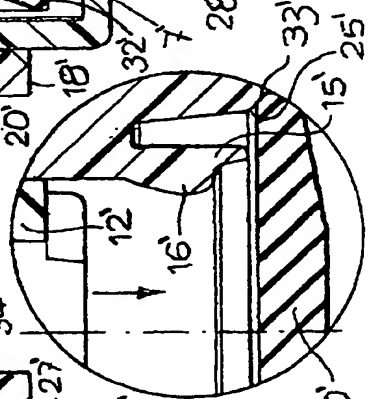

FIG_17

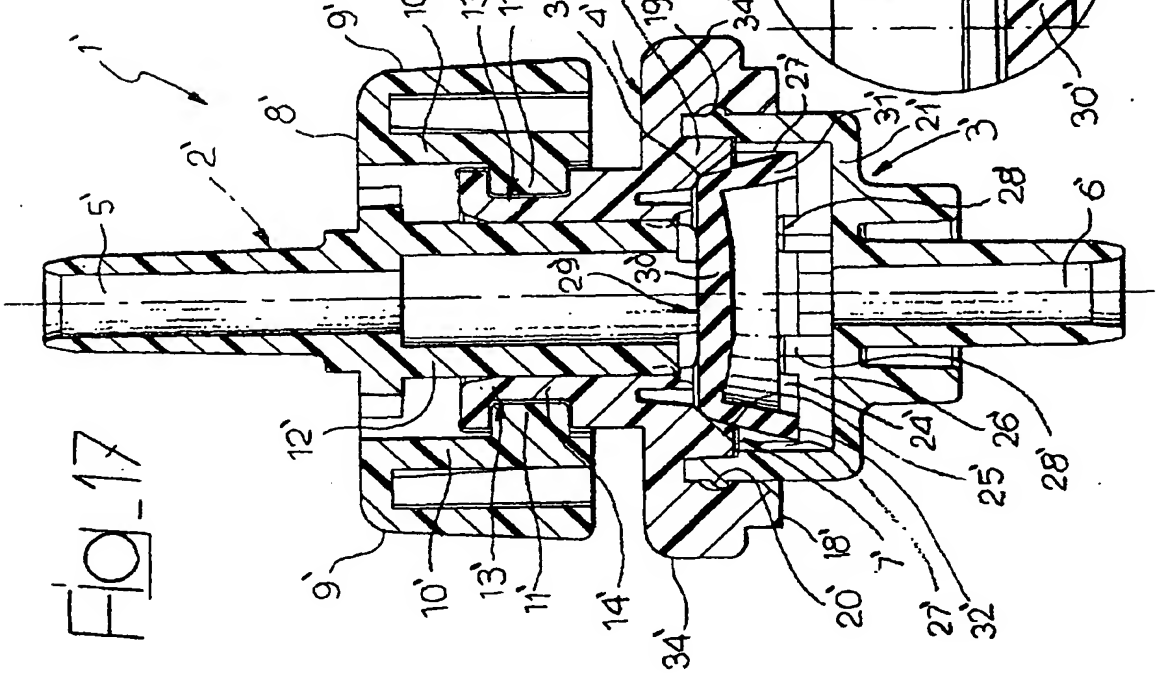

Fig_19

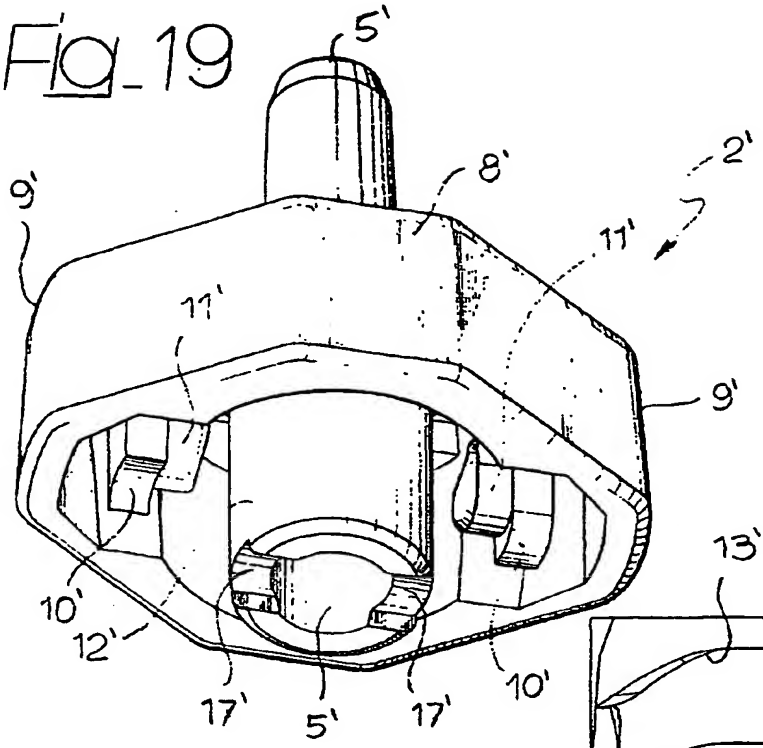

Fig_20

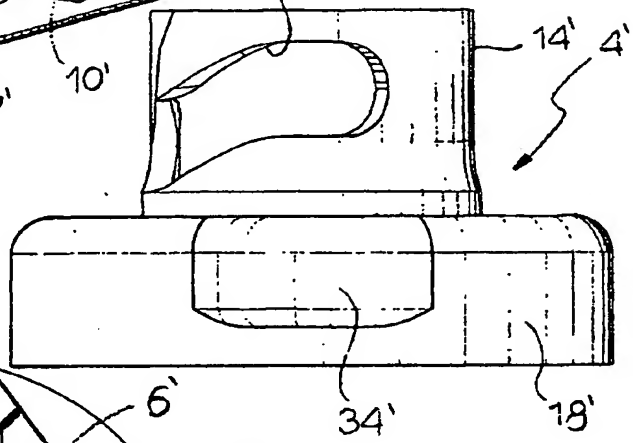

Fig_21